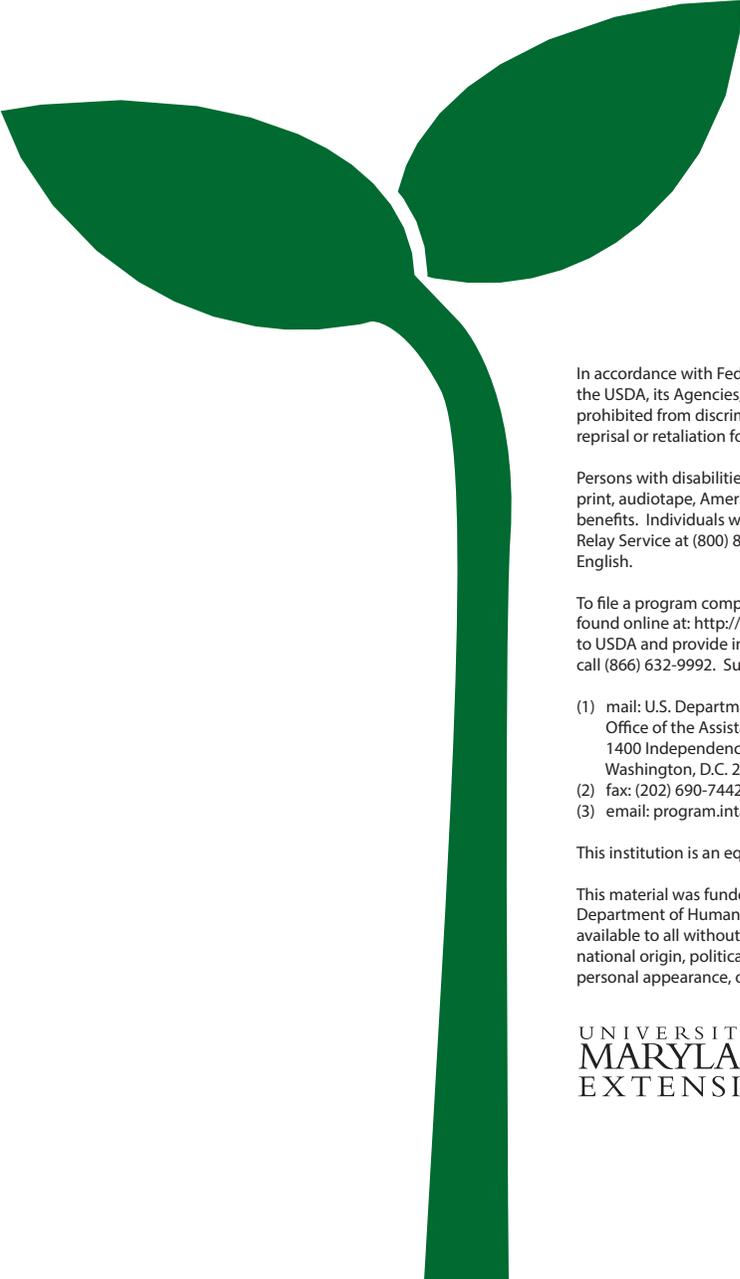


growing healthy habits





growing healthy habits

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Welcome Educators!

Extension Curricula EC-4

The Growing Healthy Habits Curriculum was developed by the University of Maryland Extension, Maryland Supplemental Nutrition Education Program (SNAP-Ed) for integrating nutrition through gardening in Maryland elementary classrooms, grades K-5. This curriculum uses gardening as a tool for encouraging students to consume more fruits and vegetables and whole grains, and increase physically activity. Growing Healthy Habits provides engaging and exciting nutrition and gardening lessons that reinforce the Maryland Common Core, as well as Environmental Literacy Standards and STEM.

Growing Healthy Habits addresses the following key behavioral outcomes:

- Make half your plate fruits and vegetables, make your grains whole grains, and switch to fat-free or low-fat milk and milk products.
- Increase physical activity and reduce time spent in sedentary behaviors as part of a healthy lifestyle.
- Maintain appropriate calorie balance during each stage of life – childhood, adolescence, adulthood, pregnancy and breastfeeding, and older age.

While a healthy diet includes eating a variety of foods from all food groups, fruits and vegetables tend to be the most under-consumed food groups among low-income individuals (Lin 2005). There is a growing body of literature supporting gardening as an effective means for increasing fruit and vegetable consumption in young people (Heim et al2009; Robinson-O'Brien, Story, & Heim 2009; McAleese & Rankin 2007). Integrating gardening education into schools or other youth education sites is only practical if the gardening program also helps meet the broad educational goals of the site.

Growing Healthy Habits provides an easy-to-use set of lesson plans that allow educators to provide learning experiences that complement their existing curriculum or programming goals, using vegetable gardening for demonstration of the concepts of the lessons. Each of the nine lesson units includes an introductory lesson, two follow-up lessons and a reflective journal lesson. A food tasting using fresh, seasonal ingredients is integrated into each unit to enhance the learning experience. While this curriculum teaches important lessons on gardening and nutrition, it is not meant to be a comprehensive experience for developing gardening skills among your students. The Appendix provides information for accessing resources for developing and maintaining a garden.

We hope that the Growing Healthy Habits curriculum helps you establish a strong nutrition education through gardening foundation for your program. Thank you for your dedication to providing children the tools they need to develop into healthy and successful adults.

Sincerely,



Heather C. Buritsch

References:

- Lin, B. 2005. Nutrition and Healthy Characteristics of Low-Income Populations: Healthy Eating Index. AIB-796-1, USDA, Economic Research Service.
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The information presented has met UME peer review standards.

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Introduction

The Growing Healthy Habits Curriculum was developed by the University of Maryland Extension, Maryland SNAP-Ed for integrating nutrition through gardening in Maryland elementary classrooms, grades K-5. This curriculum uses gardening as a tool for encouraging students to consume more fruits and vegetables and whole grains, and increase physically activity. Growing Healthy Habits provides engaging and exciting nutrition and gardening lessons that reinforce the Maryland Common Core, as well as Environmental Literacy Standards and STEM

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Using the Growing Healthy Habbits Lesson Outline

Below is quick reference outline that will simplify the process of planning lessons using Growing Healthy Habbits. The outline breaks down each unit by lesson, listing time requirements, unit standards, summary of activities, supplies list, page numbers and supplemental teacher handouts. Symbols are used throughout the curriculum to indicate special pages of the book. For example, a tasting symbol (🍴) is used to indicate where in the curriculum a tasting or healthy recipe is included in a lesson, as well as the page in the Student Journal where a copy of the recipe can be found.

Below is a key for these symbols:



Tasting/Recipe –A healthy recipe or tasting can be found in this lesson



Student Lessons and Vocabulary



Student Journal



Teacher Handouts

Unit/Lesson	Time	Unit Standards	Activities	Supplies Needed	Page #s
What's So Great About Gardening					34-65
#1 MyPlate 	30 Min	* Listening * Nutrition & fitness	* Identify healthy foods and sometimes foods * Introduce "MyPlate"	* MyPlate Kid's Poster * Food models or pictures of sometimes and all the time foods	42-44
#2 Not All Vegetables are Created Equal 	30 Min	* Listening * Nutrition & fitness Recipe: * Mathematics * Reading Informational Texts	* Taste fresh, local produce and store bought * Learn the benefits of growing and/or buying local produce when it is in season	* "Multi-sensory Taste Test" handout * Local, fresh tomatoes and store bought	45-47
#3 Food System Sequencing 	35 Min	* Listening * Economics	* Sequence steps that foods take from the farm to the table * Processed vs. unprocessed foods	* Food pictures (end of unit) * Tape	48-51
Student Journal 	20 Min	* Writing * Language standards * Nutrition & fitness		* Journal * Student vocabulary * Recipe	52-55
Teacher Handouts 					56-65
Parts of the Plant That We Eat					66-98
#1 Plant Diagrams 	45 Min	* Comprehension of informational text * Listening * Life Science	* Parts of the plant we eat * Plant part jobs	* Fruit and vegetable picture cards * Tape	74-76
#2 Parts of the Plant Salad 	40 Min.	* Listening * Life Science Recipe: * Mathematics * Reading Informational Texts	* Discuss healthy and not so healthy choices for a salad * Prepare Parts of Plant Salad	* Blank copy of "Identify Parts of the Plant We Eat" handout * "Parts of Plant Salad" recipe, ingredients and equipment	77-78
#3 Parts of the Plant Relay Race 	40 Min.	* General reading Processes * Listening * Life Science	* Six plant parts: review * Relay race to identify parts of the plant we plant, harvest and eat	* Fruit and vegetable picture cards * 12 brown paper bags	79-80

Unit/Lesson	Time	Unit Standards	Activities	Supplies Needed	Page #s
Parts of the Plant That We Eat					66-98
Student Journal 	30 Min.	<ul style="list-style-type: none"> * Writing * Language Standards 		<ul style="list-style-type: none"> * Journal * Student vocabulary * Recipe 	81-85
Teacher Handouts 					86-98
Feed the Soil and the Soil Will Feed You					99-129
#1 What is Soil Made Of? 	40 Min	<ul style="list-style-type: none"> * Comprehension of Informational Text * Listening * Measurement * Science Standards Skills and Processes * Life Science 	<ul style="list-style-type: none"> * Soil shakeup experiment * "What is Soil Made Of?" handout 	<ul style="list-style-type: none"> * Hand trowel/shovel * Clear glass jar with lid * Watch with second hand * Dry-erase marker or grease pencil 	108-112
#2 How do Different Soils Affect Our Planet? 	40 Min	<ul style="list-style-type: none"> * Listening * Science Standards Skills and Processes * Life Sciences 	<ul style="list-style-type: none"> * Soil types experiment * Soil drainage experiment 	<ul style="list-style-type: none"> * "Soil Shakeup Experiment" handout * 4 one-qt. plastic containers (reuse yogurt containers) * Scissors or pointed knife * 1 1/2 cups dried kidney beans * 1 1/2 cups flour * Sink or large plastic bin for catching water 	113-116
#3 Soil Salad 	35 Min	<ul style="list-style-type: none"> * Listening * Life Science Recipe: * Mathematics * Reading Informational Texts 	<ul style="list-style-type: none"> * "Soil Nutrients: Where did they come from? Where did they go?" * Prepare "Soil Salad" recipe 	<ul style="list-style-type: none"> * "Soil Salad" recipe * "What is Soil Made Of?" diagram * Copies of "Soil Nutrients: Where did they come from? Where did they go?" 	117-120
Student Journal 	20 Min	<ul style="list-style-type: none"> * Writing * Language Standards 		<ul style="list-style-type: none"> * Journal * Student vocabulary * Recipe 	121-124
Teacher Handouts 					125-129

Unit/Lesson	Time	Unit Standards	Activities	Supplies Needed	Page #s
Variety: The Spice of Life!					130-175
#1 Eat Your Colors 	60 Min	<ul style="list-style-type: none"> * Listening * Science Standards Skills and Processes * Life Sciences * Nutrition and Fitness Recipe: <ul style="list-style-type: none"> * Mathematics * Reading Informational Texts 	<ul style="list-style-type: none"> * Play "Take a Pick Game" * Prepare a colorful and healthy dish, "Confetti Spaghetti" 	<ul style="list-style-type: none"> * Seed catalogues * "Confetti Spaghetti" recipe ingredients, and equipment * Fruit and vegetable picture cards for "Take Your Pick Game" 	139-142
#2 Garden Survivor 	25-40 Min.	<ul style="list-style-type: none"> * Listening * Science Standards Skills and Processes * Earth/Space Science * Life Science 	<ul style="list-style-type: none"> * Play "Garden Survivor" game * Students plan their own gardens and test them with the game 	<ul style="list-style-type: none"> * Pictures of garden conditions (provided) * Pencils, markers * Copies of "Garden Survivor Cards" 	143-147
#3 Who's Who in the Garden? 	25-45 Min.	<ul style="list-style-type: none"> * Listening * Science Standards Skills and Processes 	<ul style="list-style-type: none"> * "Who's Who in the Garden" handout * Make Gardener Badges 	<ul style="list-style-type: none"> * Copies of "Who's Who in the Garden?" handout * "Gardener Badge" (optional) * Stickers, colored pencils, markers and other art supplies, * Button-making machine, if available 	148-149
Student Journal 	20 Min.	<ul style="list-style-type: none"> * Writing * Language Standards 		<ul style="list-style-type: none"> * Journal * Student vocabulary * Recipe 	150-153
Teacher Handouts 					154-175
Plan Your Planting					176-200
#1 Gimme Some Space! 	30 Min	<ul style="list-style-type: none"> * Listening * Science Standards Skills and Processes * Life Science 	<ul style="list-style-type: none"> * Keys to successful gardens, planning a garden, plant needs, how much room plants need to grow * Radish spacing experiment 	<ul style="list-style-type: none"> * 3 pint or quart-sized yogurt or deli containers * Tray or shallow bin * Potting soil * Paper or plastic cups for watering * 2 radish seed packets per experiment group * Marker * "Radish Spacing Experiment Instructions" * "Seed Spacing Experiment" 	183-185

Unit/Lesson	Time	Unit Standards	Activities	Supplies Needed	Page #s
Plan Your Planting					176-200
#2 What's On the Menu? 	35 Min	* Comprehension and Informational Text * Listening * Skills and Processes * Life Sciences	* Make observations from seed spacing experiment * "Vegetable Harvest Calendar" * "Spring Vegetable Garden Planting Plan" chart	* Seed catalogues (optional) * "Seed Spacing Experiment" handouts * Copies of "Vegetable Harvest Calendar" * "Spring Planting Table for Central Maryland"	186-188
#3 Garden on a Plate 	30 Min	* Listening * Science Standards Skills and Processes * Life Sciences * Nutrition and Fitness Recipe: * Mathematics * Reading Informational Texts	* Prepare a garden on a plate using what we have learned	* Copy of "Garden on a Plate" recipe, ingredients and equipment * "Seed Spacing Experiment" handout	189-191
Student Journal 	20 Min	* Writing * Language Standards		* Journal * Student vocabulary * Recipe	192-195
Teacher Handouts 					196-200
Seed Magic					201-226
#1 Seed Dissection 	40 Min	* Listening * Science Standards Skills and Processes * Life Science	* "Seed Dissection Experiment" * "Seeds We Eat" handout and discussion * Set up seed germination experiment	* Dry beans * 4 sandwich-size resealable bags * 4 paper towels * "Seeds That We Eat" * "Seed Anatomy and Germination" * "Seed Germination Experiment"	208-211
#2 Energy Storage in Seeds" 	50 Min	* Listening * Science Standards Skills and Processes * Earth/Space Science * Life Science	* Seed Germination Experiments: * Observe results of previous experiment and draw conclusions * Set up "Light vs. Dark" experiment	* 4 sandwich size resealable bags * 4 paper towels * 8 dry beans * "Seed Germination Experiment" handouts * "Seed in the Light vs. Seed in the Dark: The Scientific Method" handouts	212-215

Unit/Lesson	Time	Unit Standards	Activities	Supplies Needed	Page #s
Seed Magic					201-226
#3 After Germination: Photosynthesis 	50 Min	* Listening * Skills and Processes * Life Sciences Recipe: * Mathematics * Reading Informational Texts	* Observe Light vs. Dark Experiment and draw conclusions * Prepare "Seed Salad" recipe * Optional recipe: "Confetti Bean Salsa"	* 1 sandwich-size plastic bag or cup per student * Recipe, ingredients and equipment for "Seed Salad" recipe * "Seeds in the Light vs. Seeds in the Dark" handout * "Seed Salad" recipe	216-218
#4 Student Journal 	20 Min	* Writing * Language Standards		* Journal * Student vocabulary * Recipes	219-223
Teacher Handouts 					224-227
Keep it Growing					228-253
#1 Water, Water, Everywhere! 	35 Min	* Comprehension of Informational Text * Listening * Skills and Processes * Earth/Space Science * Life Science	* The importance of water to our bodies * "The Water Cycle"	* "Water Cycle" handout	237-241
#2 To Weed or Not to Weed 	25-40 Min.	* Listening * Science Standards Skills and Processes * Earth/Space Science * Life Science	* Discuss weeds and why they are not wanted in the garden * "Competition in the Garden" Game	* About 50 small paper cups	242-244
# 3 Put a Lid on It! 	40 Min.	* Comprehension of Informational Text * Listening * Science Standards Skills and Processes * Earth/Space Science * Life Science Recipe: * Mathematics * Reading Informational Texts	* Review water cycle * Weed and mulching activity * "Fizzy and Fruity Water" recipe * Optional recipe: "Crunchy Vegetable Wrap"	* 5 small pots or quart-sized yogurt cups * Potting soil * 5 pieces of paper shredded * 5 sandwich bags * 2 different color pipe cleaners (10 total or each color, cut into small pieces) * Ingredients, equipment recipe for "Fizzy and Fruity Water" * "Water Cycle" handout (completed)	245-247
Student Journal 	20 Min.	* Writing * Language Standards		* Journal * Student vocabulary * Recipe	248-252

Unit/Lesson	Time	Unit Standards	Activities	Supplies Needed	Page #s
Keep it Growing					228-253
Teacher Handouts 					253-254
Healthy Harvest					254-279
#1 Garden Inputs and Outputs 	40 Min	<ul style="list-style-type: none"> * Listening * Knowledge of Statistics * Knowledge of Number Relationships and Computation/ Arithmetic * Economics 	<ul style="list-style-type: none"> * "Value of Garden Inputs and Outputs" activity * "Garden Store Specials" * "Grocery Store Specials" 	<ul style="list-style-type: none"> * Calculators (optional) * 1 broccoli seed packet * 5 small disposable cups * "Garden Store Specials" handout * "Grocery Store Specials" handout * "Value of Garden Inputs and Outputs" handout 	261-264
#2 What's it Worth? 	30 Min	<ul style="list-style-type: none"> * Listening * Knowledge of Statistics * Knowledge of Number Relationships and Computation/ Arithmetic 	<ul style="list-style-type: none"> * Review a recipe and calculate the value of the garden produce compared to the cost at the store 	<ul style="list-style-type: none"> * "Grocery Store Specials" handout * "Produce Price Calculator" handout * Recipe for either "Garden Stir-fry" or "Harvest Fajita" 	265-267
#3 Does Money Grow on Plants? 	50 Min	<ul style="list-style-type: none"> * Listening * Measurement * Knowledge of Statistics * Knowledge of Number Relationships and Computation/ Arithmetic <p>Recipe:</p> <ul style="list-style-type: none"> * Mathematics * Reading Informational Texts 	<ul style="list-style-type: none"> * Prepare a recipe using vegetables harvested from your garden and calculate the savings of using home-grown food 	<ul style="list-style-type: none"> * "Produce Price Calculator" handout * Recipe handout from lesson #2, ingredients and equipment * Plastic grocery bags for harvesting * Scissors or hand pruners * Food scale * Calculator 	268-270
#4 Student Journal 	20 Min.	<ul style="list-style-type: none"> * Writing * Language Standards 		<ul style="list-style-type: none"> * Journal * Student vocabulary * Recipe 	271-275
Teacher Handouts 					276-279

Unit/Lesson	Time	Unit Standards	Activities	Supplies Needed	Page #s
Garden Fitness					280-303
#1 Almond Energy Burn 	35 Min	<ul style="list-style-type: none"> * Listening * Science Standards Skills and Processes * Life Science * Physics * Nutrition and Fitness 	<ul style="list-style-type: none"> * "Almond Energy Burn" activity * Observe energy in different forms 	<ul style="list-style-type: none"> • 1 almond • 1 potato (cut in half), • Paperclip • Cardboard box the size of a shoebox with the bottom cut out • Long barbeque lighter • Stopwatch 	288-291
#2 Energy in Food: Quality vs. Quantity 	35 Min	<ul style="list-style-type: none"> * Listening * Science Standards Skills and Processes * Life Science * Physics * Nutrition and Fitness 	<ul style="list-style-type: none"> * "Almond vs. Marshmallow Energy Burn" * "Reading Nutrition Facts Labels" handout 	<ul style="list-style-type: none"> • Copies of: "Reading Nutrition Facts Labels", "Almond Versus Marshmallow Nutrition Facts Label" • 1 almond nut • 1 mini marshmallow • 1 potato (cut in half) • 2 paper clips • Long barbeque lighter • Cardboard box with bottom cut out 	292-296
#3 Frozen Energy 	25 Min	<ul style="list-style-type: none"> • Listening • Nutrition and Fitness Recipe: <ul style="list-style-type: none"> • Mathematics • Reading Informational Texts 	<ul style="list-style-type: none"> * Prepare a PB&J Energy Smoothie * Learn about smart food choices and sometimes foods * Optional recipe: "Dilly Spinach Dip" 	<ul style="list-style-type: none"> • Recipe, ingredients and equipment for PB&J Energy Smoothie 	298-299
#4 Student Journal 	20 Min.	<ul style="list-style-type: none"> * Writing * Language Standards 		<ul style="list-style-type: none"> * Journal * Student vocabulary * Recipe 	300-303
Teacher Handouts 					304-305

This curriculum is intended for in-school or out-of-school youth. Each lesson has been linked to relevant Maryland State Curriculum objectives for grades one through five. In preparation for Maryland’s transition to the adoption of National Common Core Standards, a summary of Common Core State Standards for Mathematics and English Language Arts addressed across the curriculum is provided at the end of the introduction. Some adaptations to the teaching modalities may be necessary for the younger grades. However, all lessons have been successfully adapted and used with students from pre-kindergarten through high school, including special education populations.

Curriculum Organization

- **Unit organization:** The curriculum consists of nine units. Each unit contains introductory materials for the teacher, four lessons, and associated handouts. One lesson per unit includes a healthy recipe demonstration, making use of garden produce when available. The fourth lesson in each unit is a journal prompt, inviting students to reflect on and creatively respond to the content from the unit.
- **Unit introduction:** The introduction to each unit contains technical background information to support the teaching of the lessons. This information is not intended for your students, but will hopefully equip you to answer any complex questions you may receive. This is also where you will find a garden schedule to assist in synchronizing units with seasonal gardening activities. The vocabulary presented in the teacher introduction includes any words necessary for your understanding of the content. The student vocabulary presented in the Garden Journals (described below) contains age-appropriate vocabulary words and their definitions.
- **Lesson structure:** Each lesson contains an overview of what is accomplished during the lesson, learning objectives, materials and set up required, and a detailed process for proceeding through the activities. Lesson activities proceed from an introduction to the topic, to engaging discussion questions, to a hands-on learning activity. Throughout the lessons, you will find green “speech bubbles”. This is a visual indicator that the text inside the bubbles contains specific or technical concepts that might be best communicated by reading the text verbatim, at least until you are fully comfortable with the content of the lessons.

Curriculum Materials

- **Curriculum contents:** This teacher’s guide contains all lesson plans, background information, and handouts.
- **Garden Journals:** Low-income schools that commit significant time to partnering with MD SNAP-ED to implementing the Growing Healthy Habits curriculum may be eligible to have Garden Journals printed for each of your students. The Garden Journal contains the student vocabulary, recipe, and journal prompt and response for each unit.

Lesson Supplies: You can get the supplies necessary for the hands-on activities in lesson plans for free or very cheaply. Many items that will be used can be collected around your house. A comprehensive list of supplies begins on the next page. Start collecting these items to have on hand for the programming year.

Cooking Supplies: Acquiring supplies for preparing the recipes included in each unit will require a small budget. Every effort was made to streamline the cooking supplies needed to essential, low-cost items. As you begin implementing GHH, you may want to consider preparing only recipes that require the least equipment as you slowly build your cache of supplies. A comprehensive list of cooking supplies and food service items necessary to complete all cooking activities follows this page. Use this list when approaching parent groups, local businesses, or community organizations for sponsorship of your program.

In lessons that include preparing a recipe, the “Gather” section tells you the ingredients and equipment needed to prepare the dish. You will find the list of ingredients and equipment on each recipe handout included at the end of the unit. In addition to these items, you will need to have a supply available for serving the dish. These food service items, including paper or reusable plates, plastic or silverware, and napkins are included on the following supply list; you may want to have a supply on hand for food demonstration days.

Gardening Supplies: Supplies necessary for gardening will differ at every site. However, the Appendix includes a sample garden budget.

Here are some ideas to bring gardening to your site with little or no money.

- Consult the garden supply list and budgets in the Appendix and make a list of all potential sources of free or low-cost items in your community.
- Use disposable food containers, such as milk jugs or yogurt containers, for watering cans. Fill jugs with water for your plants, or punch holes in the bottom of a yogurt container to gently sprinkle water on seeds.
- Use disposable food containers as planting containers. Be sure to punch holes in the bottom of any planting container to allow water to drain through.
- Remember that most of the work your students will be doing in the garden can be accomplished with gloved hands, or perhaps trowels. Large tools (shovels, rakes) are only needed sporadically and may be borrowed from teachers, parents, or volunteers.
- Many seed companies will donate last year’s seeds free of charge. It is best to contact any local seed supplier or garden center in the fall when they are clearing out the season’s supplies. Contact the America the Beautiful Fund (<http://healthyshasta.org/downloads/gardening/Free-Seeds.pdf>) to request free seeds for your garden.
- Home and garden stores, hardware stores, and larger home renovation centers are often happy to donate to your school garden. Approach the managers of these stores personally with a letter describing your project and what you need to start growing.

Materials for Lessons:

(In addition to the handouts and visuals included with the curriculum)

- Tape
- Several paperclips
- Scissors
- Colored pipe cleaners (at least 25 total)
- Dry-erase marker or grease pencil
- Stickers, colored pencils, markers, and other art supplies
- Small paper cups (box of 50)
- Several small pots or quart-sized yogurt containers
- Paper towels
- Brown paper bags (approximately 12 total)
- Paper
- 1 cardboard box (about the size of a shoe box, or larger)
- Sandwich-size re-sealable baggies (box of 100)
- Plastic grocery bags
- Magazine pictures of fruits and vegetables (“all the time foods”) (*You may purchase food models from The National Dairy Council for \$36 per set. Call 800-220-6586*)
- MyPlate: <http://www.choosemyplate.gov/> for printable materials, SuperTracker and other tools, MyPlate videos, Healthy Eating on a Budget
- Long “barbeque” lighter
- Stopwatch or watch with a second hand
- Calculators
- Scissors or hand pruners
- Potting soil (1 small bag)
- Hand trowel or shovel
- Clear glass jar with lid
- Tray or shallow bin
- Seed catalogues (You may request free seed catalogues from companies such as Peaceful Valley Farm and Garden Supply: <http://GrowOrganic.com>, Johnny’s Select Seeds: <http://www.johnnyseeds.com> or Seeds of Change: <http://www.seedsofchange.com>, Seed Savers Exchange: <http://seedsavers.org>) or view their catalogs on-line
- Broccoli seed packet
- Several radish seed packets
- Dried beans of any variety; black, kidney, lima, pinto (1 bag)
- 1 potato
- Several almonds, raw or dry-roasted
- Several mini marshmallows
- Flour (1 bag)
- Food scale
- Optional: Button making machine (may be available through an MD SNAP-Ed partnership)
- Optional: “Diary of a Worm” book by Doreen Cronin (recommended for students in grades 1-3)

MD SNAP-Ed Partnerships

MD SNAP-Ed is funded by the Food and Nutrition Service of the United States Department of Agriculture (USDA). MD SNAP-Ed programming is fueled by documentation of the efforts that our partners in the field invest into working with us to provide nutrition education to low-income audiences. As such, sites who wish to implement the Growing Healthy Habits curriculum may be able to develop a partnership with MD SNAP-Ed to help fund materials and supplies for the program. Partnerships can be tailored to meet your site’s needs, and are based on a commitment of your time to delivering the program in exchange for MD SNAP-Ed instruction, training, resources, and expertise.

The USDA funds nutrition education and gardening supplies. However, the level of MD SNAP-Ed funding for seeds, tools and soils may be limited based on the size of the garden and other factors. In developing a partnership with MD SNAP-Ed, our educators will work with you to identify funding sources for your gardening project, or connect you with gardening experts at the University of Maryland who may be able to assist you in developing your site. If you are interested in discussing an MD SNAP-Ed partnership, please visit <https://extension.umd.edu/snap-ed>.

Maryland State Curriculum

While there is a pressing need to provide young people with tools and knowledge for making healthy dietary choices, MD SNAP-Ed recognizes that, for school garden sites, teachers’ instructional time is extremely valuable. This curriculum was developed with the intention of enhancing existing education by creating opportunities for reinforcement of classroom concepts in the garden.

The introduction to each unit includes tables that identify the Maryland State Curriculum objectives addressed in each lesson. A table for each content area (Health, Math, Reading/English Language Arts, Science, and/or Social Studies) relevant to the unit is included.

Additionally, because each unit includes a recipe, a journal prompt, and student vocabulary, tables highlighting the Maryland State Curriculum objectives that are addressed each time your students complete a recipe, journal or vocabulary review follow this page. In preparation for Maryland’s adoption of National Common Core Standards, tables highlighting Common Core State Standards addressed in each of these activities are also included. This information should help you document your teaching of grade-level standards using the lessons in the curriculum. It is our hope that the standards tables will also assist you in determining how and when to deliver the content based around opportunities to reinforce your existing curriculum.

State Curriculum Identifiers - Recipes - Reading/English Language Arts Standards

Identifier	1st	2nd	3rd	4th	5th
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Standard 2.0: Comprehension of Informational Text:

A.1.	b. Read and recognize functional documents	b. Read and identify functional documents	b. Read, use, and identify the characteristics of functional documents such as sets of directions, science investigations, atlases, posters, flyers, forms, instructional manuals, menus, pamphlets, rules, invitations, recipes, advertisements, other functional documents	b. Read, use, and identify the characteristics of functional documents such as sets of directions, science investigations, atlases, posters, flyers, forms, instructional manuals, menus, pamphlets, rules, invitations, recipes, advertisements, other functional documents	b. Read, use, and identify the characteristics of functional documents such as sets of directions, science investigations, atlases, posters, flyers, forms, instructional manuals, menus, pamphlets, rules, invitations, recipes, advertisements, other functional documents
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Common Core State Standards – Recipes – English Language Arts

Identifier	1st	2nd	3rd	4th	5th
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Reading Standards—Informational Texts

		3. Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text.	3. Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.	3. Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.	
	5. Know and use various text features to locate key facts or information in a text.	5. Know and use various text features (e.g., captions, bold print, subheadings, glossaries, indexes, electronic menus, icons) to locate key facts or information in a text efficiently.			
		6. Identify the main purpose of a text, including what the author wants to answer, explain, or describe.			

State Curriculum Identifiers - Recipes - Math Standards

Identifier	1st	2nd	3rd	4th	5th
Standard 3.0 Knowledge of Measurement:					
B.1.	b. Identify and compare units of capacity using cups and gallons	b. Measure capacity of objects using cup, pint, quart, liter, and gallon	b. Measure capacity of containers to the nearest cup, pint, quart, gallon, milliliter, and liter using graduated containers		
Standard 6.0 Knowledge of Number Relationships and Computation/Arithmetic:					
A.2.	a. Read, write, and represent fractions as parts of a single region using symbols and models with denominators of 2 or 4	a. Read, write, and represent fractions as parts of a single region using symbols or models with denominators of 2, 3, or 4	a. Read, write, and represent fractions as parts of a single region using symbols, words, and models		
Standard 7.0 Processes of Mathematics:					
D.1.	b. Identify mathematical concepts in relationship to other disciplines	b. Identify mathematical concepts in relationship to other disciplines	b. Identify mathematical concepts in relationship to other disciplines	b. Identify mathematical concepts in relationship to other disciplines	b. Identify mathematical concepts in relationship to other disciplines
D.1.	c. Identify mathematical concepts in relationship to life	c. Identify mathematical concepts in relationship to life	c. Identify mathematical concepts in relationship to life	c. Identify mathematical concepts in relationship to life	c. Identify mathematical concepts in relationship to life

These objectives are touched on in the recipes, but not to the extent they would be in a Math lesson. The recipes can be used to complement Math or modified to suit the teacher's needs. Additionally, the teacher may plan extensions to Growing Healthy Habits activities to the connections to the Math curriculum.

Common Core State Standards – Recipes – Mathematics

Identifier	1st	2nd	3rd	4th	5th
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Numbers and Operations—Fractions (NF)					
			1. Understand a fraction as the quantity formed when a whole is partitioned into equal parts.	1. Explain why a fraction is equivalent to a fraction by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size.	1. Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators.
			2. Compare two fractions with different numerators and different denominators.	2. Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators.	
			3.b. Recognize and generate simple equivalent fractions. Explain why the fractions are equivalent, e.g., by using a visual fraction model.		
			4.a. Understand a fraction a/b as a multiple of $1/b$.		
Measurement and Data (MD)					
			1. Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit.		
			2. Measure and estimate liquid volumes and masses of objects using standard units.		
					3. Recognize volume as an attribute of solid figures and understand concepts of volume measurement.

State Curriculum Identifiers - Journals - Reading/English Language Arts Standards (R/ELA)

Identifier	1st	2nd	3rd	4th	5th	Lesson #s
Standard 4.0 Writings:						
A.1.		c. Organize related ideas into a simple paragraph		a. Generate and select topics using techniques such as graphic organizers, journal writing, free writing, listing, webbing, and discussion of prior experiences		4 (all units)
A.2.		a. Write to express personal ideas using a variety of forms, such as journals, narratives, letters, and reports	a. Compose to express personal ideas to develop fluency using a variety of forms such as journals, narratives, letters, reports, and paragraphs	a. Compose to express personal ideas to develop fluency using a variety of forms suited to topic, audience, and purpose		4 (all units)
A.2.		b. Contribute to a shared writing experience or topic of interest	e. Use writing-to-learn strategies such as journals, admit/exit slips, diagrams, drawings, graphic organizers, and “think-aloud’s on paper” to connect ideas and thinking about lesson content	e. Use writing-to-learn strategies such as learning logs, dialogue journals, and quickwrites to connect ideas and thinking about lesson content		4 (all units)

These objectives are touched on in the journals, but not to the extent they would be in a full Reading/English Language Arts lesson. The journals can be used to complement R/ELA lessons or modified to suit the teacher’s needs. Additionally, the teacher may plan extensions to Growing Healthy Habits activities to enrich the connections to the R/ELA curriculum.

1st	2nd	3rd	4th	5th
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Writing Standards

1. Write opinion pieces in which they introduce the topic they are writing about, state an opinion, supply a reason for the opinion, and provide some sense of closure.	1. Write opinion pieces in which they introduce the topic they are writing about, state an opinion, supply reasons that support the opinion, use linking words to connect opinion and reasons, and provide a concluding statement or section.	1. Write opinion pieces on topics or texts, supporting a point of view with reasons.	1. Write opinion pieces on topics or texts, supporting a point of view with reasons.	1. Write opinion pieces on topics or texts, supporting a point of view with reasons.
2. Write informative/explanatory texts in which they name a topic, supply some facts about the topic, and provide some sense of closure.	2. Write informative/explanatory texts in which they introduce a topic, use facts and definitions to develop points, and provide a concluding statement or section.	2. Write informative/explanatory texts to examine a topic and convey ideas and information clearly.	2. Write informative/explanatory texts to examine a topic and convey ideas and information clearly.	2. Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
		3. Write narratives to develop real or imagined experiences or events using effective technique, descriptive details, and clear event sequences.	3. Write narratives to develop real or imagined experiences or events using effective technique, descriptive details, and clear event sequences.	3. Write narratives to develop real or imagined experiences or events using effective technique, descriptive details, and clear event sequences.
		4. With guidance and support from adults, produce writing in which the development and organization are appropriate to task and purpose.	4. Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.	4. Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.
8. With guidance and support from adults, recall information from experiences to answer a question.	8. Recall information from experiences to answer a question			
Language Standards—Conventions of Standard English				
1. Demonstrate command of the conventions of standard English grammar and usage when writing.	1. Demonstrate command of the conventions of standard English grammar and usage when writing.	1. Demonstrate command of the conventions of standard English grammar and usage when writing.	1. Demonstrate command of the conventions of standard English grammar and usage when writing.	1. Demonstrate command of the conventions of standard English grammar and usage when writing.
2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.	2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.	2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.	2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.	2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.
3. Use knowledge of language and its conventions when writing, speaking, reading, or listening.	3. Use knowledge of language and its conventions when writing, speaking, reading, or listening.	3. Use knowledge of language and its conventions when writing, speaking, reading, or listening.	3. Use knowledge of language and its conventions when writing, speaking, reading, or listening.	3. Use knowledge of language and its conventions when writing, speaking, reading, or listening.



Common Core State Standards – Vocabulary – English Languages Arts

1st	2nd	3rd	4th	5th
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Language Standards—Vocabulary Acquisition and Use				
		4.d. Use glossaries or beginning dictionaries, both print and digital, to determine or clarify the precise meaning of key words.	4.c. Consult reference materials (e.g., dictionaries, glossaries, thesauruses) to find the pronunciation and determine or clarify the precise meaning of key words and phrases.	4.c. Consult reference materials (e.g., dictionaries, glossaries, thesauruses) to find the pronunciation and determine or clarify the precise meaning of key words and phrases.
6. Use words and phrases acquired through conversations, reading and being read to, and responding to texts.	6. Use words and phrases acquired through conversations, reading and being read to, and responding to texts.	6. Acquire and use accurately grade-appropriate conversational, general academic, and domain-specific words and phrases.	6. Acquire and use accurately grade-appropriate conversational, general academic, and domain-specific words and phrases.	6. Acquire and use accurately grade-appropriate conversational, general academic, and domain-specific words and phrases.

The Scientific Method

While gardening provides wonderful opportunities for cross-disciplinary learning, science is one content area that is consistently represented in the GHH lessons. Science testing has been added to Maryland State Assessments, and providing students with foundations in the sciences will become increasingly important. In many of the GHH lessons, students participate in simple experiments to answer questions about processes in the garden. For each experiment, they are provided with a handout that guides them through using the scientific method to answer a question. The handout asks them to complete sections describing the hypothesis, results, and conclusions of the experiment. In completing these experiments, it might be useful to review or introduce the scientific method as the standard process for testing and answering a question. The scientific method includes the following basic steps:

1. Observing a phenomenon and formulating a question
2. Doing background research
3. Constructing a hypothesis
4. Testing the hypothesis with an experiment
5. Analyzing results
6. Drawing conclusions
7. Repeating experiment or developing new questions based on the conclusions

For more information on teaching the scientific method, we recommend the following website:
http://www.sciencebuddies.org/science-fair-projects/project_scientific_method.shtml

Linking to the Garden: While the lessons can be taught in any order, at any time of year, they are most meaningful when they are reinforced by gardening activities relevant to the content, and when produce from the garden can be used in the recipes. To help you accomplish this, we have provided a “Linking to the Garden” section in each unit’s introductory materials, which includes:

- The best month for implementing the unit
- What to plant
- What might be available to harvest for the unit’s recipe or other uses
- Other gardening activities that reinforce the content of the unit

Two separate unit sequences are provided: one for school year (September - June) programs (page 29), and one for growing season (March - October) programs found on (page 30). In the school year sequence we have not recommended content for December, due to scheduling conflicts around holiday breaks. The schedule for each type of program is summarized in a master timeline on the following pages. Please note that “Garden Fitness” is a ‘bonus’ unit discussing physical activity in the garden. It can fit anywhere in the flow of lessons, and works particularly well when there are vigorous physical tasks to complete in the garden.

Vegetable selections: The recommendations for what to plant is by no means a comprehensive list of what can be grown in a Maryland vegetable garden; we have focused on planting vegetables that are either used in the recipes, or which are easy to grow and prepare in a youth gardening program. The planting schedule is also paced so that something can be planted each month during the growing season (rather than just in May). If you are able to plan and plant a more diverse garden, by all means do so! But if you are just starting out, following the recommendations will help you plan for a successful first season.

Harvesting: Exactly when your garden produces its first cucumber will depend entirely on uncontrollable and unpredictable variables such as rain, soil temperature, and sun; however, we have done our best to give guidelines that will help you plan when you might be able to complete a recipe activity using garden produce. However, if you plan to make a “Plant Parts Salad” or other recipe using garden produce, visit the garden frequently to assess when you might expect to have harvestable lettuce or radishes before buying other ingredients. In many recipes, you can substitute whatever you happen to have available from the garden for the vegetables listed.

When to garden: Planting, harvesting, or other gardening activities are not explicitly written into any of the lesson plans. While it might be ideal to follow a lesson immediately with garden work, finding the time to get your students outside is dictated by many factors, including your daily schedule and weather events. The best time to get your students to complete the suggested gardening activities is whenever you can find the time! This curriculum provides enough content for four lessons per month (roughly one lesson per week); it should be expected that, at some point, lessons are sacrificed in favor of time spent in the garden. That said, given that journal prompts are brief activities, you may want to consider following garden journaling with a visit to the garden.

Unit Sequence and Gardening Schedule

for Schoolyear Programs



Unit #	Title	Recommended Month	Plant	Harvest	Other
1	What's So Great About Gardening?	September	<u>Transplant:</u> Collards, kale, lettuce <u>Direct seed:</u> Radishes	Tomatoes for taste test, if you had a summer garden.	General garden maintenance.
2	Parts of the Plant That We Eat	October	<u>Direct Seed:</u> Garlic Cover crop (late October)	Lettuce and radishes for "Plant Parts Salad," other salad vegetables may be available.	Sow cover crop seeds, general garden maintenance.
3	Feed the Soil...and the Soil Will Feed You!	November	None	Lettuce and leafy greens for "Soil Salad"; any other vegetables that may still be available in your fall garden.	Pull out spent plants and make compost pile, cover garden soil with leaves or other mulch.
4	Variety: The Spice of Life!	January	None	None	Use seed catalogues to select any special varieties you want to grow in the garden this year.
5	Plan Your Planting	February	<u>Start transplants indoors (mid to late February):</u> Cabbage, lettuce	None	Students help create a garden map and planting schedule; teachers and volunteers meet to create a supply list, a plan for acquiring materials, and a maintenance schedule.
6	Seed Magic	March	<u>Start transplants indoors:</u> Broccoli, collards, kale <u>Transplant (mid-March):</u> Cabbage, lettuce <u>Direct seed (mid-March):</u> Peas, radishes, spinach	None	Work compost or other organic matter into the garden a week or two before planting, build trellis for peas, thin seedlings (radishes, spinach) a few weeks after planting.
7	Keep It Growing	April	<u>Transplant:</u> Broccoli, collards, kale <u>Direct seed:</u> Carrots <u>Start indoors:</u> Sweet potato slips	Leafy greens, lettuce, and spinach to send home with students (late April).	Thin carrots (a few weeks after planting); water, weed, and mulch your garden to reinforce the concepts learned in this unit.
8	Healthy Harvest	May	<u>Transplant:</u> Cucumbers, eggplant, peppers, squash, sweet potatoes, and tomatoes (if garden will be maintained through summer)	<u>Mid- to late- May:</u> Baby carrots, garlic, leafy greens, and radishes for "Garden Stir-fry" (Note: carrots and garlic will need some time to mature; harvest the biggest for the recipe and leave the rest to grow until the end of the school year).	Plan for summer garden care; general garden maintenance.
9	Garden Fitness is an extra unit that may be incorporated anytime during the schoolyear.				

Unit Sequence and Gardening Schedule for Growing Season Programs



Unit #	Title	Recommended Month	Plant	Harvest	Other
1	Plan Your Planting	March	<u>Start transplants indoors (early March):</u> Broccoli, collards, kale <u>Transplant (mid- March):</u> Cabbage, lettuce <u>Direct seed (mid March):</u> Peas, radishes, spinach	None	Students help create a garden map and planting schedule; teachers and volunteers meet to create a supply list, a plan for acquiring materials, and a maintenance schedule; work compost or other organic matter into garden a week or two before planting; build trellis for peas.
2	Seed Magic	April	<u>Start transplants indoors:</u> Broccoli, collards, kale <u>Transplant (mid-March):</u> Cabbage, lettuce <u>Direct seed (mid-March):</u> Carrots, peas, radishes, spinach	None	Work compost or other organic matter into the garden a week of two before planting, build trellis for peas, thin carrots and radishes (a few weeks after planting).
3	Parts of the Plant That We Eat	May	<u>Transplant:</u> Eggplant, peppers, tomatoes <u>Direct seed:</u> Beans, cucumbers, summer squash (note: cucumbers and squash can also be planted from transplants)	Lettuce, spinach, peas and radishes for "Plant Parts Salad"	Thin cucumbers and summer squash (a few weeks after planting), trellis tomatoes and cucumbers, general gardening maintenance.
4	Keep It Growing	June	<u>Transplant:</u> Sweet potatoes	Beans, broccoli, cucumbers kale, collards, summer squash to send home with students.	Water, weed, and mulch your garden.
5	Feed the Soil... and the Soil Will Feed You!	July	<u>Transplants (late July):</u> Broccoli, cabbage, cauliflower, collards, kale <u>Direct seed (late July):</u> Carrots	Cucumbers, peppers, tomatoes, and any other available vegetables for "Soil Salad" (send surplus home with students).	Pull out spent plants and make compost pile, mulch, work compost into fall vegetable beds as your plant; thin carrots (a few weeks after planting); general garden maintenance.
6	Healthy Harvest	August	<u>Direct seed:</u> Lettuce, radishes	Eggplant, garlic, peppers (sweet and hot), summer squash, and tomatoes for "Harvest Fajitas".	Thin radishes (a few weeks after planting); general garden maintenance.
7	Variety: The Spice of Life!	September	<u>Direct seed:</u> Spinach	Red bell peppers or tomatoes for "Confetti Spaghetti"; If planted in mid to late summer, you may also have red cabbage, cauliflower, and carrots for the recipe.	General garden maintenance.
8	What's So Great About Gardening?	October	<u>Direct seed:</u> Garlic Cover crop (late October)	Tomatoes for tomato taste test (you may complete the activity using any available garden vegetable to compare to grocery store vegetables).	General garden maintenance; harvest all summer vegetables and send home with students before first frost, sow cover crop seeds.
9	Garden Fitness is an extra unit that may be incorporated at anytime during the growing season.				

Cooking in the Classroom:

The thought of preparing food in the classroom with students can be intimidating. While managing a lot of little hands using tools and utensils may be challenging, it is well-worth the effort when students are willing to try new or unfamiliar foods because they invested in their preparation.

Classroom management: In general, being prepared is the best way to ensure that a cooking activity stays manageable. You may want to have all vegetables washed, and difficult vegetables (e.g. onions) already chopped and ready before the activity. Think about the different tasks involved in the preparation and how they can be divided among students so that everyone gets a chance to contribute. Keep students busy and minimize transition time. For example, when a student finishes chopping their kale, they can start collecting other students’ cutting boards and knives as they finish.

Allergies: Before completing any food preparation activity, be sure you or the teacher are aware of any food allergies among the students. Lessons that include foods such as nuts contain an additional cautionary reminder. Work with the school nurse to determine student allergies and procedures within the school. It is recommended to have parents complete a form that describes any food sensitivities students may have before you begin the curriculum. If you are required by your principal or school, a parent letter requesting permission for student participation in the program, describing safety measures, and requesting allergy information, is provided in the Appendix.

Food safety: It is extremely important that food preparation is done with proper hygiene in mind. Keep a container of sanitizing wipes on hand to wipe down work surfaces before beginning food preparation. All students should wash hands thoroughly before beginning cooking activities. The steps to proper handwashing include:

1. Wet your hands with warm water
2. Apply soap
3. Rub your hands together including between your fingers and around fingernails for 20 seconds
4. Rinse thoroughly
5. Dry your hands using a paper towel



In lessons involving food preparation, a reminder about proper handwashing is included in the lesson plan, and a handwashing icon is on the recipe to remind students and their families about the importance of clean hands in maintaining food safety. Hand sanitizing gels can be used for quick sanitizing if hands have touched unclean surfaces during food preparation, but preparing food should always be preceded with a soap-and-water handwashing.

Tasting etiquette: Many of the recipes in this curriculum will contain foods that are new or unfamiliar to your students. Before you prepare your first dish, be sure to discuss the rules for food tasting. Explain to students the many reasons why they should not react negatively to a food they are sampling: they, and many others, invested time and energy into its preparation, which should not be treated with disrespect; other students might like the dish and they should not try to influence other’s opinions; and they might find that they enjoy the food later in life as their tastes change and develop.

Types of gardens: This curriculum can be complemented by a diversity of garden types, ranging from small container gardens to larger, in-ground gardens. Do not think that you have to create a large-scale “edible schoolyard” for the program to be effective; the lessons will have just as much weight if they are taught using a container garden comprised of five or six pots. In fact, small container gardens may be more relevant to what students can replicate at home. We always recommend that you start small, concentrating on implementing the lessons instead of building a large, maintenance-intensive garden.

Planning your garden: You will need to consider many things before starting a garden at your school. We have designed a Youth Gardening Program Planning table to help you brainstorm ideas to develop your program. This tool is intended to help initiate thoughts about the goals of your program, potential garden sites, as well as financial, physical and educational resources. This planning table can be found in the Appendix.

Support for the garden: If you will be developing the garden space that will complement this curriculum, it’s important that you start by recruiting support at your site. Find one or two other people that will share responsibility for coordinating the garden. Ask other teachers, parents, parent liaisons, or someone in the community to help the garden for teaching. Make sure you have the support of the school principal and administrators.

You don’t have to be the “garden guru” in order to grow vegetables at your school! Focus your energy on developing the program format, assessing and making use of available resources. There are lots of great gardening resources for teachers, including web resources, print materials, and knowledgeable volunteers who are available to help with details. Learn what’s available and use it! See the Appendix for a list of gardening resources and a planning document to help you identify and organize the resources that will get your gardening program off to a strong start.

Garden maintenance: We suggest designating after-school time for garden maintenance. Giving up valuable in-school instructional time for weeding and watering is not feasible or appropriate, and this strategy will likely result in an uncared for garden. While it is important that students who are exposed to the curriculum have the opportunity to reinforce that knowledge through planting, harvesting, and relevant maintenance, day-to-day maintenance is best displaced to non-school time. You will have to decide how and when your students will spend time in the garden independent of the time spent implementing these lessons.

Safety in the garden: Gardening and food preparation is a ton of fun, but it is extremely important to keep proper safety precautions in mind. The University of Maryland Extension’s “Grow it Eat it” program has created a Food and Garden Safety tool that is an excellent reference for school gardeners working with youth. This resource provides recommendations for garden locations and addresses everything from safe garden tool practices to proper food harvest and storage. A copy of the Food and Garden Safety document can be found in the Appendix.

It is important that your students have a clear understanding of the rules for working in the garden. A simple list of garden rules might include:

- No running.
- No raising tools above the waist.
- Do not use voices louder than would be used inside.
- Do not pick any plants unless given permission.

Working with youth in the garden: Before you get started, have a plan in mind for how you will engage lots of students in the process. Know your list of tasks and divide students into groups before you get out to the garden. With younger students, keeping things in control may require some additional structure, such as having students form lines and taking turns completing their tasks. Using tools such as marking flags or large rulers will help students plant at proper spacing and free you from having to guide each individual student.

And finally, it is important that you remain flexible. Gardening is always full of surprises and unanticipated teachable moments. Even a dead plant can be turned into an investigation of what happened, rather than a failed venture. Don't get discouraged when things don't work out as planned, have fun, and learn along with your students.

What's So Great About Gardening?

1. Understanding MyPlate
2. Not All Vegetables Are Created Equal
3. Food System Sequencing
4. Garden Journal

What's So Great About Gardening?

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Unit Introduction:

Students of all ages know that fruits and vegetables are important for a healthy diet. However, there are many barriers that prevent people from consuming enough fresh fruits and vegetables. These lessons introduce gardening as a way of overcoming these barriers, including the barrier of taste! Students will taste tomatoes from various sources to demonstrate that vegetables taste different depending on where and how they are grown. They will also learn to think about where their food comes from, and use this knowledge to help make healthy food choices.

Teacher Vocabulary:

1. Understanding MyPlate

In-season - food grown locally during a given time of year. Fruits and vegetables are “in-season” at different times of year throughout the country.

Local - food grown near the point of final sale or consumption. Local produce can be purchased at farmers’ markets and some grocery stores.

Phytonutrients - a bioactive plant substance that is not essential for human nutrition, but considered to have a beneficial effect on human health, especially disease prevention. Also called phytochemicals.

2. Not All Vegetables Are Created Equal (No Vocabulary)

3. Food Systems Sequencing

Farmers’ Market - a place where people can buy fruits and vegetables directly from the farmers that grew them.

Processed - foods whose final form is created through many steps and the combination of many ingredients, including preservatives and flavor enhancers.

Linking to the Garden: (refer to pages 28 through 30 in the curriculum Introduction)

Schoolyear Programs

Recommended Month: September

Plant:

Transplant: Collards, kale, lettuce

Direct seed: Radishes

Harvest: Tomatoes for taste test, if you have a summer garden

Complimentary gardening activities: General garden maintenance

Growing Season Programs

Recommended Month: October

Plant:

Direct seed: Garlic, Cover crop (late October)

Harvest: Tomatoes for tomato taste test (you may complete the activity using any available garden vegetable to compare to grocery store vegetables)

Complimentary gardening activities: General garden maintenance; harvest all summer vegetables and send home with students before first frost, sow cover crop seeds

Background:

Eating a variety of fruits and vegetables every day is a step toward better health that everyone should take. Diets rich in fruits and vegetables are associated with reduced risk of chronic disease, such as diabetes, high blood pressure, and certain types of cancer. Fruits and vegetables provide key nutrients such as vitamins A and C, folate (a B vitamin), magnesium, potassium, and fiber. However, most Americans do not consume enough fruits and vegetables due to barriers such as high cost, lacking knowledge of storage and preparation methods, and unfamiliarity with or distaste for available produce.

Gardening is an excellent means of empowering people to overcome these barriers and increase their consumption of fruits and vegetables. While gardening requires an investment of funds, a small, well-managed garden can provide a family with an abundance of produce from April through October. Gardeners develop a strong relationship with the food they grow, which encourages them to find creative ways to prepare them, and fosters food skill development. Finally, garden produce is always fresh, making it tastier and more nutritious than produce at grocery stores. Many gardeners may find that they like vegetables that they had previously disliked because they had only tasted out-of-season varieties available at the grocery store. This is because most produce in the grocery store is grown on commercial farms in places like California, Florida, and South America and distributed by long distance trucking to its final point-of-purchase. While we are lucky that we have access to fresh produce year round, long distance shipping often means that produce is picked before it is fully ripe, and it continues to lose flavor and nutrients along its journey to your table. Furthermore, a greater variety of crops can be grown in the garden than what might be available at food stores, allowing people to identify and grow different types of produce that suit their tastes and customs.

This unit is designed to expose students to a variety of fresh produce, and offer the opportunity to taste, smell, and see the differences between fresh, locally-grown foods and those found in the grocery store. The lessons will also highlight the differences between processed and unprocessed foods. Students will learn that there are often many steps involved in getting food from the farm to their table. Understanding that process can guide decisions about whether a food is healthy or unhealthy.

State Curriculum Identifiers - What's So Great About Gardening? - Health Standards

Identifier	1st	2nd	3rd	4th	5th	Lesson #/s
Standard 6.0 Nutrition and Fitness						
A.1.	a. Differentiate how the five senses affect food choices.					1
D.1.		a. List the six major nutrients: water; fat; vitamins; minerals; carbohydrates; and protein (only bold items covered).	a. Describe the six major nutrients and how the body uses them (only discusses vitamins and minerals).	a. State how nutrients in foods contribute to health.		1
D.1.		b. Name a food source for each nutrient.		c. Summarize why the body needs vitamins and minerals.		1
E.1.	a. Describe how food keeps the body healthy by maintaining strong bones, muscles, and teeth and preventing illness.					1
F.1.	a. Recognize the MyPyramid as an outline for healthy eating.					1
F.1.				b. Identify factors that influence food choices.		1, 2
F.1.	b. Explain the location of the food groups on the MyPyramid.	b. Specify the number of servings recommended per day from each group (only fruit and vegetable groups).				1
F.1.	c. Demonstrate why it is important to eat at least five servings of fruits and vegetables a day, such as "Fruits and Veggies: More Matters."					1, 4

State Curriculum Identifiers - What's So Great About Gardening? - Social Studies Standards

Identifier	1st	2nd	3rd	4th	5th	Lesson #s
Standard 4.0 Economics						
A.2.	a. Give examples of natural and human resources used in production, such as making butter, making ice cream, and building houses.	a. Identify the natural, capital, and human resources used in the production of a good or service.	c. Describe steps in the production process to produce a product.			3
B.1.	b. Identify markets in the local community, such as grocery stores, farmers' markets, toy stores, and fast food restaurants.					3

Lesson #1: Understanding MyPlate

Time Required: 30 minutes (classroom activities: 30 minutes)

Lesson Overview:

1. Students will engage in a discussion about the importance of fruits and vegetables in a healthy diet, and how gardening can be used to overcome barriers to eating the recommended amounts of fruits and vegetables.

Students will learn that:

- Fruits and vegetables are essential to a healthy diet because they provide vitamins, minerals, fiber, and other nutrients.
- Many people do not eat enough fruits and vegetables for a variety of reasons.
- Gardening may help overcome many of the barriers to consuming fruits and vegetables.

Gather

- Food models or magazine pictures of junk foods (“sometimes foods”) and food models or magazine pictures of fruits and vegetables (“all the time foods”)
- MyPlate graphic:
<https://www.myplate.gov/resources>

Process:

Introduction (5 minutes)

1. Explain to students that they are going to discuss the importance of nutrition and healthy eating.
2. Explain that it is important to learn good eating habits when we are young. Unhealthy eating habits can cause health problems later in life. If we eat poorly all of our lives, it is hard to change our habits when we develop health problems. If we eat healthy all of our lives, we will be less likely to get sick when we are older.

Engagement (5 minutes)

Discussion Questions

1. What does it mean to be healthy?
2. How would you describe a healthy diet?
3. How can you tell if a food is healthy or not?

Key Points

1. A healthy person is not sick and has enough energy for work and for play.
2. A healthy diet includes foods from all food groups that provide our body with energy and nutrients, which allow our bodies to grow and function properly.
3. Sometimes it's hard to tell if a food is good for us by the way it tastes. Many foods taste good but aren't so good for our bodies. We are about to learn which foods are healthy and can be eaten all the time and which foods are not as healthy and are "sometimes foods."

Activity (20 minutes) Identifying Healthy Foods

SUMMARY OF ACTIVITY

1. Students will identify healthy ("all the time") and less healthy ("sometimes") foods, and discuss why many people don't choose healthy diets. They will then discuss how gardening can help overcome barriers to healthy eating.

Activity Process (20 minutes)

1. Explain to students that you will quiz them on which foods are healthy and less healthy. Explain that while it's okay to eat unhealthy foods sometimes as special treats, we should try to eat healthy foods every day.
2. Hold up different food models and have students decide if they are "sometimes foods" or "all the time foods."
3. Discuss with students what all the healthy foods have in common. Point out that they are all fruits and vegetables.
4. Explain that fruits and vegetables provide our bodies with nutrients such as vitamins, minerals and fiber, and it's important to eat them every day.
5. Explain that there are many healthy foods in other food groups. However, we are going to focus on fruits and vegetables, because many people do not get enough of them in their diet.
6. Display the MyPlate graphic.
7. Ask students how much of the plate is filled with fruits and vegetables.
8. SAY:

Doctors and scientists have learned that filling half your plate with fruits and vegetables at every meal is the best way to stay healthy.

9. Ask students if they think they fill half their plate with fruits and vegetables at every meal. Explain that most people do not.

If most people, including kids, know that they should be eating lots of fruits and vegetables, why don't they?

10. List all students' responses on the board. Encourage students to be honest and think broadly, to include reasons such as: dislike taste, never tried them before, high cost, not available, hard to cook/store.

11. Explain to the class that they have just listed some barriers to eating enough fruits and vegetables. Discuss the definition of a barrier (see Student Vocabulary, page 55)

12. Explain that gardening is a great way to overcome many of the barriers to consuming fruits and vegetables. Go back through the list and discuss how gardening can help people overcome barriers to eating fruits and vegetables. Below are some examples you can offer:

a. Dislike for produce is a barrier to eating fruits and vegetables. Home-grown vegetables are often fresher and tastier than grocery store vegetables. We can also grow vegetables that are not available in the grocery store, so gardeners might discover new vegetables that they like.

b. Lack of availability of produce in neighborhood food stores is a barrier to eating fruits and vegetables. Gardening provides access to fresh produce in the community.

c. The high cost of produce is a barrier to eating fruits and vegetables. After you pay for materials to start your garden, garden-grown fruits and vegetables are free!

d. Thinking that fruits and vegetables go bad quickly is a barrier to purchasing produce. Produce from the garden stays fresh longer than fruits and vegetables from the grocery store because they are picked fresh, and not shipped across the country.

13. Explain that gardening helps us learn where our food comes from and how to cook with fresh produce. Hopefully this will help us overcome some of the barriers to eating enough fruits and vegetables. Eating more produce will help us have healthier diets.

Lesson #2: Not All Vegetables are Created Equal

Time required: 30 minutes (classroom activities: 30 minutes)

Lesson Overview:

1. Students will be offered a taste test of tomatoes from different sources: some from the grocery store, and a few varieties from a local farm or from the garden. The students will use a handout to guide them in using all of their senses to experience the difference in the tomato varieties from different sources.

Students will learn that:

- Fruits and vegetables are essential to a healthy diet. They provide vitamins, minerals, fiber, and other nutrients.
- Fruits and vegetables picked fresh from the garden during the growing season often taste different than those grown in far away places and shipped to the grocery store.
- Gardening allows us to experience varieties of produce that may taste different than what we have experienced in the past.
- In order to judge whether we like or dislike foods, we need to use all of our senses.

Gather

- Ingredients for the taste test:
 - Three varieties of local tomatoes from the garden and/or a farmers' market or farm stand (See <http://www.marylandsbest.net> for a list of farmers' markets in your county); buy enough for every student to have a small taste of each variety. Try to find varieties that are strikingly different in color, size, and shape.
 - One variety of tomatoes from the grocery store (not a locally grown variety; you may try to find an underripe variety to ensure a dramatic contrast in flavor); buy enough for each student to have a small taste
- Equipment for the taste test: knife, cutting board, napkins or paper plates

Setup:

- Make copies of the "Multi-sensory Taste Test" handout
- Wash tomatoes
- Assemble taste test materials

Process:

Introduction (5 minutes)

1. Review key points from Lesson #1, discussing various barriers to eating enough fruits and vegetables, and how gardening can help us overcome these barriers.
2. Explain that it is easy to understand how gardening helps overcome some barriers, such as not having places to purchase fruits and vegetables in your neighborhood, or the high cost of fruits and vegetables. However, some might not realize that gardening can also help to overcome a dislike of fruits and vegetables.

Engagement (5 minutes)

Discussion Questions

1. What are some of the different places you can get healthy foods?
2. Do the same fruits and vegetables always taste the same? What is an example of a time when you had a fruit or vegetable that tasted different from past experiences with that same fruit or vegetable?

Key Points

1. Many of us probably get most of our food from the grocery store. However, we can also buy food directly from farmers at farmers' markets or farm stands. We can also grow some of our own fruits and vegetables.
2. Fruits and vegetables are tastiest when eaten during the season in which they naturally grow. Produce can be purchased fresh from farms not far from our homes. Buying fruits and vegetables "in-season" might help us find new fruits and vegetables that we like.

Activity (20 minutes) Multi-sensory Taste Test

SUMMARY OF ACTIVITY

In this tasting activity, students will sample tomatoes from the grocery store as well as some that were locally grown, and describe how each tastes, feels, looks and smells. Students will practice comparing several types of one particular food from different sources, so that they can recognize the differences between the varieties provided. Students will discuss their preferences and draw conclusions from the taste test.

Key Points

1. Tasting things slowly and thoughtfully will help us recognize new flavors and open our minds to new varieties.
2. Gardening will give us opportunities to experience new varieties of vegetables, as well as produce that is fresher than what we can buy at the store.

Activity Process (20 minutes)

1. Explain to the class that they are going to taste test several varieties of tomatoes. Some of the tomatoes were purchased at the grocery store, which means they were probably grown on big farms far away from here and shipped across the country to the store. Others were purchased at a farmers' market. This means that they were grown on a farm close to here, and picked and sold just a few days ago. These represent tomatoes that we could grow in a garden during the summer.
2. **NOTE:** Remember to review with students the importance of clean hands when preparing food. Have all students wash their hands before they handle the food. The curriculum introduction has a useful description of proper hand-washing techniques.
3. Remind students of taste testing rules. They should focus on experiencing new flavors and textures. It is okay if they do not like some of the samples, but their reactions must be polite.
4. Pass out the "Multi-sensory Taste Test" handouts and explain the process of the taste test. Students should read each question and record their responses before moving on to the next step in the taste test.
5. Cut the tomatoes and pass out samples of the different varieties, allowing the students time to record their observations between tastes. Be sure to keep each tomato's origin a secret until after students have recorded their thoughts.
6. Discuss their conclusions from the taste test. How were the tomatoes different? How were they similar?
7. Reveal which tomatoes were locally-grown. Explain that these are similar to what would be grown in a garden. Review and discuss the reasons that locally- or home-grown tomatoes taste, look, and smell different than grocery store tomatoes.
8. Review and discuss the fact that vegetables such as tomatoes, come in many types and varieties that have different flavors. Gardening allows us to grow and eat different varieties of vegetables that are not found in the grocery store.

Lesson #3: Food System Sequencing

Time Required: 35 minutes (classroom activities: 35 minutes)

Lesson Overview:

1. Students will uncover the many steps it takes to get a food from where it is grown to our plates. They will discuss how the steps from field to table affect the taste and nutrition content of our food.

Students will learn that:

- Even though it is sometimes hard to tell, all food comes from farms or nature.
- Getting food from the ground to our stomachs may require many steps.
- The different steps food takes from where it is grown to when it is eaten affects its taste and nutrition.
- Gardening helps us understand where our food comes from which can help us make good food choices.

Gather

- Pictures of (provided as an attachment to this unit):
 - Cereal box
 - Corn on the cob
 - Garden
 - Farm
 - Farmers' market
 - Factory
 - Tractor trailer
 - Grocery store
- Tape

Setup:

- Clear space on your chalkboard or wall for taping pictures in sequence.

Process:

Introduction (5 minutes)

1. Review the conclusions from Lessons #1 and #2: fruits and vegetables taste different depending on when, where, and how they are grown. Growing fruits and vegetables in our garden can help us enjoy certain fruits and vegetables that we didn't think we liked.
2. Tell students that growing food in our garden also helps teach us where food comes from, which can help us make healthy food choices.

Engagement (5 minutes)

Discussion Questions

1. Could we grow all of the food that we need to eat in our garden?
2. What are some healthy foods that we will not be able to grow in our garden?

Key Points

1. We cannot grow all of the foods that we need in our garden. Fruits and vegetables are only one part of a healthy diet.
2. A healthy diet also includes things like whole grain breads and cereals, low-fat dairy products, and lean meats and beans. We are not able to grow all of these things in our garden, so we must get them from other sources.

Activity (25 minutes) Farm to Table

SUMMARY OF ACTIVITY

Students will sequence the various steps that various foods take from farm to table. They will use this exercise to draw conclusions about the difference between processed and unprocessed foods.

Key Points

1. All foods began on a farm, yet there are often many steps involved in getting our food from the farm to our dinner table. A processed food is one that has been through many steps and changes between the farm and your plate.
2. Unprocessed foods have been through fewer steps from farm to table, and they are generally more healthy than processed foods.

Activity Process (25 minutes)

1. Explain that it often takes many steps to get our food from farms to our bellies. The class will use a box of Corn-based cereal to help understand those steps.
2. Spread the gathered pictures out on the table. Separate the pictures of the cereal box and corn on the cob and tape to the board on the right-hand side above one another.

Note: You can also complete this activity by selecting students to hold and display cards at the front of the room.

3. Ask students where they would purchase a box of Corn Pops®.
4. Have a student identify the picture of the grocery store. Tape it to the table to the left of the Corn Pops® box.
5. Ask how the food got to the grocery store.
6. Have a student identify the picture of the tractor trailer. Tape it on the board to the left of the grocery store picture.
7. Ask where the truck picked up the box of cereal.
8. Have a student identify the picture of the factory. Explain that a factory is a building where useful things are made. In this case, the factory made cereal and put them in a box. Tape the picture to the board to the left of the tractor trailer picture.
9. Explain that the factory needed ingredients and materials in order to make the cereal. Ask how the ingredients and materials got to the factory.
10. Have a student identify the second picture of the truck and tape it to the board to the left of the factory.
11. Finally, ask what the main ingredient in this cereal is, and where it came from.
12. Have a student identify the picture of a farm as the source of the corn used to make the cereal. Tape it to the board to the left of the picture of the factory.
13. Review the sequence of steps required to make the cereal. Corn was grown on the farm, it was transported to a factory, where it was processed and packaged, and it was shipped on a truck to the grocery store where it can be available for us to buy.
14. Point to the picture of corn-on-the-cob.
15. Explain that corn-on-the-cob grows right from the ground. It doesn't need to go to the factory before we buy it. It can go straight to the grocery store or farmers' market for us to buy.
16. Rearrange the picture sequence to show the corn coming from the farm straight to the grocery store.
17. Ask if there any other places we can get corn-on-the-cob.
18. Allow the students to identify farmers' markets and gardens as other places we can get corn-on-the-cob. Explain that farmers' markets are places where farmers bring food that they grow on their farms for people to buy.
19. Explain that most foods from farmers' markets are very fresh and healthy. However, if we have a garden, we can grow healthy food for ourselves, and we don't even have to purchase it!
20. Discuss the nutritional difference between processed and unprocessed foods.

Discussion Questions

1. What types of foods can we get straight from the garden or farm?
2. What are examples of foods that must be made in a factory before they are shipped to a grocery store and sold?
3. Which group of foods (foods that come straight from the farm or garden OR processed foods) are healthier food choices? Why?
4. Ask if they think they can identify processed foods. You may want to test them by giving them examples of foods and having students categorize them as processed or unprocessed.

Key Points

1. Fruits, vegetables, and eggs are examples of foods that we can get straight from the garden or farm. These are considered unprocessed foods because they have not been changed from their natural state.
2. Chips, donuts, and other junk foods are examples of foods that must be made in a factory and shipped to the grocery store. These are called processed foods.
3. Processed foods are less healthy because they often have unhealthy ingredients such as salt, sugar, and fat added to them to preserve them or to enhance their flavor. This is because these foods are not eaten fresh.
4. Usually, unprocessed foods are healthier than processed foods. Explain that imagining the steps a food takes from the farm to plate will help to decide if a food is processed or unprocessed (many steps = processed; few steps = unprocessed or minimally processed).

Journal

Time required: 20 minutes (classroom activities: 20 minutes)

Lesson Overview:

1. Students will write a creative written response to a prompt related to the content covered in the “What’s So Great About Gardening?” Unit.

Process:

1. Read the prompt aloud to your students. After answering any questions, allow them time to write a response in their Garden Journals.

Prompt:

Imagine we were going to try to sell some of our garden produce to other students at the school, and you are going to have time during the morning announcements to encourage students to buy our vegetables. Write a commercial for our garden produce that could be used on the morning announcements. Be sure to include details that describe how and where it was grown, and how that affects its taste and freshness, as well as the importance of fruits and vegetables for good health.



Student Vocabulary

Barrier - something that prevents something else from happening.

Factory - a place where things are made by combining and changing materials into something new.

Farm - a place where food is grown for a large number of people.

Farmers' market - a place where people can buy fruits and vegetables from the farmers who grow them.

Garden - a place where food is grown for a family or community.

In-season - food grown locally during a given time of year. Different fruits and vegetables are “in-season” at different times of year throughout the country.

Local - food grown near where it is sold. Local produce can be purchased at farmers' markets and some grocery stores.

Nutrients - vitamins and minerals used by living organisms to grow and be healthy. Plants get their nutrients from the air, soil, and water; humans get nutrients from their food and water.

Processed - foods created through many steps and the combination of many ingredients, usually adding salt, sugar, fat, and artificial ingredients.

Produce - fresh fruits and vegetables.

Shipping - the process of moving goods from one place to another, often from the place they were grown or made to the place they will be sold.



Multi-sensory Taste Testing Worksheet

Sample A

Write a word(s) describing how it looks:

Write a word(s) describing how it smells:

Now place the sample in your mouth, but don't swallow it right away. Chew it slowly and notice its texture as well as its flavor.

Write a word(s) describing how it feels in your mouth:

Write a word(s) describing how it tastes:

Sample B

Write a word(s) describing how it looks:

Write a word(s) describing how it smells:

Now place the sample in your mouth, but don't swallow it right away. Chew it slowly and notice its texture as well as its flavor.

Write a word(s) describing how it feels in your mouth:

Write a word(s) describing how it tastes:

Sample C

Write a word(s) describing how it looks:

Write a word(s) describing how it smells:

Now place the sample in your mouth, but don't swallow it right away. Chew it slowly and notice its texture as well as its flavor.

Write a word(s) describing how it feels in your mouth:

Write a word(s) describing how it tastes:

Sample D

Write a word(s) describing how it looks:

Write a word(s) describing how it smells:

Now place the sample in your mouth, but don't swallow it right away. Chew it slowly and notice its texture as well as its flavor.

Write a word(s) describing how it feels in your mouth:

Write a word(s) describing how it tastes:



Based on your observations, decide which sample you preferred. Write the letter of the sample that you liked better in the box at the left.



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CORN CEREAL





GARDEN





FARM





TRUCK



Parts of the Plant That We Eat

1. Plant Diagrams
2. Parts of the Plant Salad
3. Parts of the Plant Relay Race
4. Garden Journal

Parts of the Plant That We Eat?

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Unit Introduction:

The “Parts of the Plant” unit introduces the students to basic plant anatomy, which is important knowledge for any gardener. In this unit, students will begin to understand where their food comes from. This knowledge will help them start thinking of their food in the context of living plants. By understanding what they are actually consuming when eating fruits and vegetables, these healthy foods are demystified and students are more likely to eat them. This knowledge also lays the foundation for gardening concepts that will be revisited all season.

This unit helps the student understand the different parts of plants, and that all fruits and vegetables originate as one of the six parts. Students will learn about, write about, and taste the parts of the plant.

Teacher Vocabulary:

1. Plant Diagrams

Flowers - the site of a plant where reproduction occurs, where an unfertilized egg becomes fertilized by pollen. Broccoli and cauliflower are closed flower buds. If they were allowed to continue to grow, they would open up into small yellow flowers.

Fruits - the plant part that contains seeds. Tomatoes, cucumbers, squash, peppers, and eggplant are the fruit of the plant, although they are designated as vegetables if categorized by food group.

Leaves - specialized plant parts that are the main sites of photosynthesis. Green leaves are high in chlorophyll, the chemical that turns water and carbon dioxide into simple sugars and oxygen using the energy in sunlight.

Photosynthesis - the process that occurs in plant leaves that turns water and carbon dioxide into simple sugars and oxygen using the energy in sunlight.

Root - the part of the plant that absorbs water and nutrients from the soil. The root also anchors the plant.

Seeds - a plant embryo encased in a seed coat and containing an energy source.

Stem - the part of the plant that transports water and energy around the plant, similar to our veins and arteries. Stems transport water and nutrients from the roots up, and sugars from the leaves down.

Transpiration - the process of water moving through a plant from the roots, up the stem, and eventually into the air through pores in the leaves.

Vegetable - any plant whose fruit, seeds, roots, tubers, bulbs, stems, leaves, or flower parts are used as food. The term “vegetable” is a culinary term that includes foods that are botanically designated as fruits (e.g. tomatoes, cucumbers) based on their flavor and typical use in savory (rather than sweet) preparations.

2. **Parts of the Plant Salad** (No Vocabulary)

3. **Parts of the Plant Relay Race** (No Vocabulary)

Linking to the Garden: (refer to pages 28 through 30 in the curriculum Introduction)

Schoolyear Programs

Recommended Month: October

Plant: Garlic

Harvest: Lettuce and radishes for “Plant Parts Salad”, other salad vegetables may be available

Complimentary gardening activities: General garden maintenance

Growing Season Programs

Recommended Month: May

Plant:

Transplant: Eggplant, peppers, tomatoes

Direct seed: Cucumbers and summer squash (note: can also be planted as transplants)

Harvest: Lettuce, peas, radishes, and spinach for “Plant Parts Salad”

Complementary gardening activities: Thin cucumbers and summer squash (a few weeks after planting), trellis tomatoes and cucumbers, general gardening maintenance

Background:

Many young people do not understand that the fruits and vegetables that they eat come from specific parts of the plant. This presents a unique opportunity for science and nutrition education, coupling the names and functions of plant parts with lessons that expose students to healthy fruits and vegetables.

Plant parts can be divided into two main categories: parts that help the plant grow, and parts that help the plant reproduce. It is best to divide the parts this way when teaching this unit so that the function as well as the relationship between different plant parts are well understood.

Roots, stems, and leaves are the plant parts that help the plant grow. They are responsible for transpiration and photosynthesis. Roots absorb water and nutrients from the soil which are then transported upward by the stem and into the leaf. The leaf uses the water and nutrients as well as energy from the sunlight to make sugars which are transported down the stem to the rest of the plant. The sugar is the energy that the plants use to make the complex carbohydrates, fiber, and proteins that become the source of nutrients and energy humans get when they eat plants. The nutrients plants get from the soil are analogous to vitamins and minerals that humans get from our food.

The plant parts that help the plants reproduce are the flowers, fruits, and seeds. Wind and insects pollinate flowers, which turn into fruits that contain seeds. All fruits have seeds inside of them. Seeds are the mechanism by which most plants reproduce. The seeds inside the fruits can be planted and will grow into a new plant.

Any food that has seeds inside of it is technically the fruit of the plant. This includes things we often think of as vegetables, such as tomatoes, peppers, and squash. The term “vegetable” is a culinary designation that describes edible plant parts that are usually used in savory, rather than sweet, preparations. Fruit and vegetable food groups on MyPlate are referring to the culinary, rather than botanical, categorization of plant foods. In other words, tomatoes, peppers, eggplant, cucumbers, and squash are a fruit if you are categorizing them by plant part, and a vegetable if you are categorizing them by food group.

State Curriculum Identifiers - Parts of the Plant - Reading/English Language Arts Standards

Identifier	1st	2nd	3rd	4th	5th	Lesson #/s
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Standard 1.0 General Reading Processes

D.2.	a. Sort grade-appropriate words with or without pictures into categories	a. Classify and categorize words into sets and groups, such as animals, adult/baby				3
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Standard 2.0 Comprehension of Informational Text

A.2.	b. Use graphic aids	b. Use graphic aids	b. Use graphic aids such as illustrations and pictures, photographs, drawings, sketches, cartoons, maps (key, scale, legend), graphs, charts/tables, and diagrams	b. Use graphic aids such as illustrations and pictures, photographs, drawings, sketches, cartoons, maps (key, scale, legend), graphs, charts/tables, and diagrams, other graphic aids encountered in informational texts	b. Use graphic aids such as illustrations and pictures, photographs, drawings, sketches, cartoons, maps (key, scale, legend), graphs, charts/tables, and diagrams, other graphic aids encountered in informational texts	1
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Standard 4.0 Writing

A.2.			b. Describe in prose and poetry by using sensory details and vivid language with active verbs and colorful adjectives	b. Describe in prose and poetry by using purposeful imagery and sensory details with active verbs and colorful adjectives		4
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Standard 6.0 Listening

A.1.	a. Attend to the speaker	a. Attend to the speaker	a. Attend to the speaker	a. Attend to the speaker	a. Attend to the speaker	1, 2, 3
A.1.	b. Respond appropriately to clarify and understand	c. Respond appropriately to clarify and understand	c. Respond appropriately to clarify and understand	c. Contribute relevant comments	c. Contribute relevant comments	1, 2
A.1.				d. Relate prior knowledge	d. Relate prior knowledge	1, 2, 3
A.2.	c. Demonstrate an understanding of what is heard by retelling, asking questions, and relating prior knowledge	c. Demonstrate an understanding of what is heard by retelling, asking questions, relating prior knowledge, and summarizing	c. Demonstrate an understanding of what is heard by retelling, asking questions, relating prior knowledge, and summarizing	c. Demonstrate an understanding of what is heard by retelling, asking questions, relating prior knowledge, and summarizing	c. Elaborate on the information and ideas presented	2

State Curriculum Identifiers - Parts of the Plant - Reading/English Language Arts Standards continued

Identifier	1st	2nd	3rd	4th	5th	Lesson #s
Standard 6.0 Listening						
A.2.	d. Follow a set of multi-step directions		2, 3			
A.2.					d. Draw conclusions based on the information presented	2
A.2.	e. Listen carefully to expand and enrich vocabulary	e. Listen carefully to expand and enrich vocabulary	e. Listen carefully to expand and enrich vocabulary	e. Listen carefully to expand and enrich vocabulary	e. Listen carefully to expand and enrich vocabulary	1, 2, 3



State Curriculum Identifiers - Parts of the Plant - Science Standards

Identifier	1st	2nd	3rd	4th	5th	Lesson #s
3.0 Life Science:						
B.2.	c. Describe some parts of plants and describe what they do for the plant					1, 2, 3

Lesson #1: Plant Diagrams

Time required: 45 minutes (classroom activities: 45 minutes)

Lesson Overview:

1. Students will discuss basic plant anatomy and function by labeling a diagram.
2. Students will use a diagram to match foods with the plant part from which they originate.

Students will learn that:

- Fruits, vegetables, beans, and grains come from specific parts of a plant.
- Each part of a plant plays a specific role in plant growth or reproduction.
- All plant-based foods (fruits, vegetables, beans, and grains) come from one of the six basic plant parts.

Gather

- Fruit and Vegetable Picture Cards
- Tape

Setup:

- Make copies of the following handouts for each student:
 - “Identify Parts of the Plant We Eat”
 - “Plant Parts Diagram”
- Cut out Fruit and Vegetable Picture Cards (if not already completed from previous use).
- Separate carrots, celery, spinach, broccoli, peas, and tomatoes from the picture cards to have ready during the first part of the lesson.

Process:

Introduction (5 minutes)

1. Introduce the concept that plants are made up of different parts, just like people.

To be a good gardener, you have to know how all the parts of a plant work to help the plant grow to be healthy. This is similar to how a doctor needs to know all the parts of your body. Can someone name one part of the plant?

Engagement (10 minutes)

Discussion Questions

1. What are some of the parts of your body, and what do they do?
2. What are some parts of a plant, and what do those parts do?

Key Points

1. Like a person, a plant is made up of many parts, each with different functions. While all the parts are responsible for keeping the plant healthy, each plays a specific role that no other plant part can do.

Activity (30 minutes)

SUMMARY OF ACTIVITIES

In both activities, students will learn the names, functions, and examples of the six parts of the plant using the “Identify Parts of the Plant We Eat” and “Plant Parts Diagram” handouts.

NOTE: It is very important to connect each of the plant parts back to the foods that we eat. Always use examples of edible plants to help the students better understand the concepts being taught. If your school has a garden, use the plants in the garden to show real examples of all six parts of a plant. Or provide examples of fruits and vegetables they are familiar with. When describing the plant parts, use the Fruit and Vegetable Picture Cards that are included with the handouts to show examples of vegetables and fruits.

Activity Process #1 (20 minutes) “Identify Parts of the Plant We Eat” handout

1. Pass out a copy of the “Identify Parts of the Plant We Eat” handout to each student.
2. Have the students label the different plant parts on their handout. If you have a document projector, project the color version of the handout so students can follow along.
3. Identify and explain the function of each plant part. Dividing the plant parts into two groups will help students better understand their function. The key concepts for each plant part are listed below:
 - a. The parts that help the plant grow and be healthy:
 - **Roots:** the part of the plant that is underground, sucks up water and nutrients from the soil, and keeps the plant in place.
 - **Stem:** the part of the plant that moves the water and nutrients from the roots to the leaves, and the energy, or food, from the leaves to the roots.
 - **Leaves:** the part of the plant that turns sunlight and water into plant food, or energy. This process is known as photosynthesis.

b. The parts that help the plant reproduce, or make new plants:

- **Flower:** the part of the plant that produces new seeds.
- **Seeds:** the part of the plant that, when planted, will grow into a new baby plant.
- **Fruit:** the part of the plant that holds the seed.

4. During this activity, students should be writing the names of the plant parts in the correct spaces on their handout.

5. Explain that all fruits and vegetables that we eat come from one of these six plant parts.

6. Display the six Fruit and Vegetable Picture Cards. Challenge the students to guess which part of the plant each comes from. If you are projecting the image of the plant on a screen or wall, they may come up to tape the picture to the screen on the part of the plant that it comes from:

- a. Carrots: roots
- b. Celery: stem
- c. Spinach: leaves
- d. Broccoli: flower
- e. Tomato: fruit
- f. Peas: seeds

7. Explain that the term “fruit” can be confusing because it is used to describe a plant part as well as a food group.

8. SAY:

“If we are categorizing tomatoes by plant part, we call them a fruit because they are the part of the plant that contains seeds. However, if we are categorizing tomatoes by food group, rather than plant part, they are considered a vegetable because of their taste and how they are used in cooking. This is also true of cucumbers, peppers, squash, and eggplant.”

Make sure the handouts are kept so they can be used during the next lesson.

Activity Process #2 (10 minutes) “Plant Parts Diagram” handout

1. Pass out the “Plant Parts Diagram” handout to each student and explain that web diagrams are one way to organize information.
2. Have one student read the words in the center bubble. Ask what they think should be written in the outer bubbles.
3. Instruct students to write the name of one plant part in each of the outer bubbles.
4. Explain that they will write the names of up to three fruits, vegetables, or grains on the lines near the outer bubble that names the part of the plant the food comes from. You may use the stack of Fruit and Vegetable Picture Cards to help them think of different plant foods and identify the plant part they come from.
5. Have them write the names of the fruits and vegetables in the appropriate place on the diagram during the discussion. There is an answer key provided for your reference.

Lesson #2: Parts of the Plant Salad

Time required: 40 minutes (classroom activities: 15 minutes; food demo: 25 minutes)

Lesson Overview:

1. Students will review the material learned in Lesson #1, and be given the opportunity to see, touch, and taste each of the parts of the plant.

Students will learn that:

- Each part of the plant is used for a specific function by that plant.
- We eat healthy and tasty foods that come from each of the parts of the plant.

Gather

- A blank copy of the “Identify Parts of the Plant We Eat” handout from Lesson #1
- Ingredients for “Plant Parts Salad” recipe + “Growing Healthy Habits Vinaigrette” recipe (if using)
- Equipment for “Plant Parts Salad” recipe + “Growing Healthy Habits Vinaigrette” recipe (if using)

Setup:

- Harvest (or purchase), wash and chop all vegetables for “Plant Parts Salad”, reserving scraps for compost pile if applicable. Harvest and wash herbs if making your own vinaigrette dressing
- Make copies of the “Plant Parts Salad” and “Growing Healthy Habits Vinaigrette” (if using) recipe.

Process:

Introduction (10 minutes)

1. SAY:

Today we’re going to taste all the different parts of the plant. But, before we do that, we need to recall all six parts of the plant and what they do.

2. Use the “Identify Parts of the Plant We Eat” handout to review the six parts of a plant. Ideally, you would use the handout on a document projector and have students come up and write on the handout for the whole class to see.

3. Remind students that these plant parts each have a function in helping the plant grow and reproduce. There are also examples of healthy foods that come from each plant part, so they help humans grow and be healthy too!

Engagement (5 minutes)

Discussion Questions

1. What are your favorite salad ingredients?
2. Are all salad ingredients healthy?
3. Which of your favorite salad ingredients are healthier choices?

Key Points

1. Salads are a great way to eat more healthy fruits and vegetables.
2. What you put in a salad is important! Colorful vegetables, beans, and low-fat cheese are healthy salad ingredients, but if you add too much salad dressing, high-fat cheese, or artificial ingredients (such as dried bacon), your salad becomes less healthy.
3. The “Plant Parts Salad” is made of a variety of vegetables and low-fat dressing, making it a very healthy salad.

Activity (25 minutes) “Plant Parts Salad” Recipe

SUMMARY OF ACTIVITY

Students will create and eat a salad made up of each of the six different parts of the plant.

Activity Process (25 minutes)

1. Hand out a bowl to each student.
2. Explain to the students that they are going to create a healthy and tasty salad using each of the six plant parts.
3. **NOTE:** Remember to review with students the importance of clean hands when preparing food. Have all students wash their hands before they begin to handle the food. The curriculum introduction has a useful description of proper hand-washing techniques.
4. As students add each ingredient to the salad bowl, ask them to recall what part of the plant it comes from.
5. Toss salad and serve in individual bowls, giving each student a serving of salad dressing. A recipe for a homemade vinaigrette dressing is included for those who would like to engage students in making their own dressing.
6. Encourage students to share the “Plant Parts Salad” recipe with their family.

Lesson #3: Parts of the Plant Relay Race

Time required: 40 minutes (outdoor or classroom activities: 40 minutes)

Lesson Overview:

1. Students will review the concepts of this unit with a fun and active relay race.

Students will learn that:

- All plant foods come from one of the six plant parts.
- There are many fruits and vegetables to choose from! We should eat vegetables every day.

Gather

- Fruit and Vegetable Picture Cards
- 12 brown paper bags

Setup:

- Label each of the brown paper bags with the name of one of the six plant parts (roots, stem, leaves, flower, fruit, seeds). Each plant part will be written on two bags.

Process:

Introduction (5 minutes)

1. Bring the students outside into the garden area or an open space inside the school, and divide them into two teams. It may be helpful to remind them of garden rules, and appropriate behavior when they are outside in the garden.
2. Explain to them that their plant part knowledge is going to be tested through a relay race.

Engagement (5 minutes)

Discussion Questions

1. What are the six different parts of the plant?
2. What are six different things that we eat that are examples of the six plant parts?

Key Points

1. Roots, stems, leaves, flowers, fruit and seeds are the six different plant parts.
2. Every plant food comes from one of these six parts. Understanding which part of the plants in the garden will be picked and eaten will make us better gardeners.

Activity (30 minutes) Parts of the Plant Relay Race

SUMMARY OF ACTIVITY

Students will participate in a relay race that requires them to categorize vegetables and fruits according to the part of the plant it comes from.

Activity Process (30 minutes)

1. Have students line up with their teams.
2. Set up the opened bags some distance away from the two teams (approximately 20 feet).
3. Explain the rules of the relay race:
 - I. There are six paper bags for each team, each labeled with a part of the plant.
 - II. Each student will receive one card containing a picture of a fruit or vegetable.
The first student of each team will run to the bags, put their fruit or vegetable card in the bag labeled with the corresponding plant part, and then run back to tag the next student.
 - III. When all the team members have put their cards in the correct bags, they should sit down.
4. SAY:

In order to win this relay race, your team has to finish first, but you also have to have put the cards in the correct bag. If you finish first but there is an incorrect card, you have to correct your mistakes before your team wins.

5. After the first team finishes, stop the race. Take all of their cards out of the bags, one bag at a time, and ask the class if each one is correct. Take out any incorrect cards. Give the incorrect cards back to the team and restart the race. Repeat until a team finishes and has all matches completely correct.
6. If desired or more time remains, play the game again giving students a different card set than the first game.

Journal

Time required: 30 minutes (classroom activities: 30 minutes)

Lesson Overview:

1. Students will write a creative written response to a prompt related to the content covered in the “Parts of the Plant” unit.

Process:

1. Divide the class into six groups, and assign each group to a part of the plant.
2. Read the prompt aloud to your students. Make sure that everyone understands how to write an anagram poem. You may want to write an example on the chalk board to ensure that everyone knows how to write this type of poem.
3. After answering any questions, allow them time to write a response in their Garden Journals.
4. After the students are done writing their poem, have each student present to the class.

Prompt:

Now that we all know and understand the different parts of the plant, we are going to write an anagram poem. Start by writing the name of your plant part down the left-hand side of your paper. Then, write a poem where each line starts with the first letter on each of the lines. So, if your plant part is “roots”, your poem would have lines starting with the letters “R, O, O, T, and S”. Write your poem about what it would be like to be that part of the plant.



Garden Journal

Name: _____

Now that we all know and understand the different parts of the plant, we are going to write an anagram poem **describing** what it would be like to be that part of the plant. Start by writing the name of your plant part down the left-hand side of your paper. Then, **write a poem** where each line starts with the first letter on each of the lines. So, if your plant part is "roots", your poem would have lines starting with the letters "R, O, O, T, and S".

Blank lined area for writing the poem.



Student Vocabulary

Flower - the part of the plant where seeds are made.

Fruit - the part of the plant that protects the seed. All fruits have seeds inside of them.

Leaves - the part of the plant where photosynthesis happens.

Photosynthesis - the process that plants use to get energy from the sun to grow and be healthy.

Roots - the part of the plant that is underground and soaks up water and nutrients from the soil.

Seed - the part of the plant that, when planted and given warmth and water, can grow into a baby plant.

Stem - the part of the plant that moves water from the roots to the leaves and energy from the leaves to the roots and rest of the plant.

Vegetable - a food group that includes foods that are plant roots, stems, leaves, flowers, fruits, and seeds. Vegetables are usually not as sweet as foods in the fruit food group.



Growing Healthy Habits Vinaigrette Dressing Recipe

This dressing uses herbs to add flavor. A small drizzle will dress up any salad.

Dresses one large salad (20 sample portions or 10 side salads)

Ingredients:

2 tablespoons vinegar or lemon juice

3 tablespoons olive oil

1 teaspoon honey

1 teaspoon Dijon mustard

¼ teaspoon salt

¼ teaspoon black pepper

1 tablespoon chopped and washed fresh herbs, such as chives, oregano, and/or basil, or 1 teaspoon dried herbs



You will need:

Mixing bowl and whisk OR

Jar with tight-fitting lid

Directions:

1. Place all ingredients in mixing bowl or jar.
2. Whisk or shake until well-blended.



**REMEMBER TO
WASH YOUR HANDS**



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cantaloupe



winter squash



sweet potato



carrots





apricots



tomato



tomato



red pepper





red pepper



red onion



spinach



spinach





kale



kale



collard greens



garlic

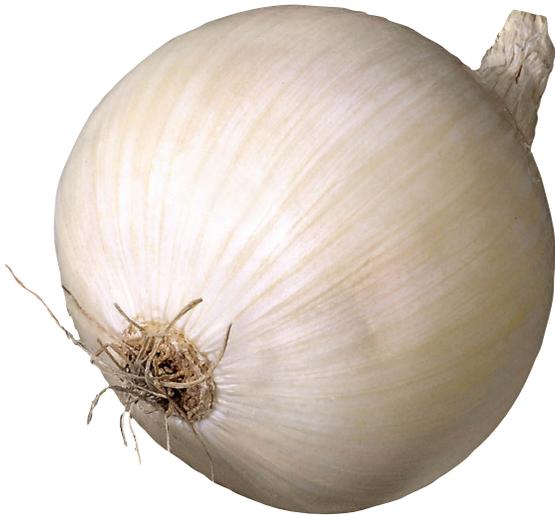




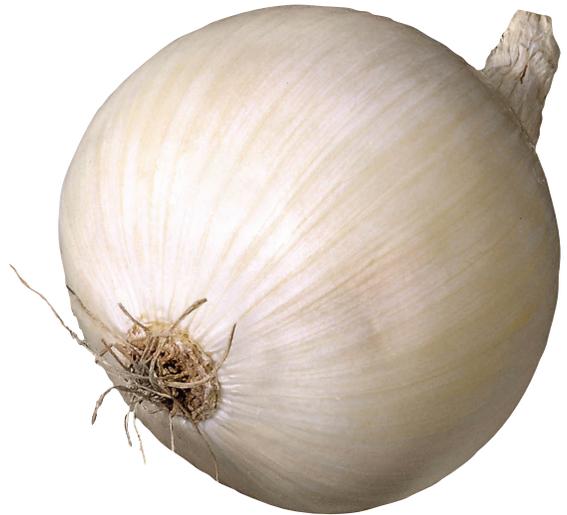
garlic



garlic



white onion



white onion





purple grapes



blackberries



blueberries



plums





raisins



brown rice



corn



broccoli





cauliflower



asparagus



celery



peas





turnips



potatoes



radishes



beets





cilantro



whole wheat bread



rhubarb

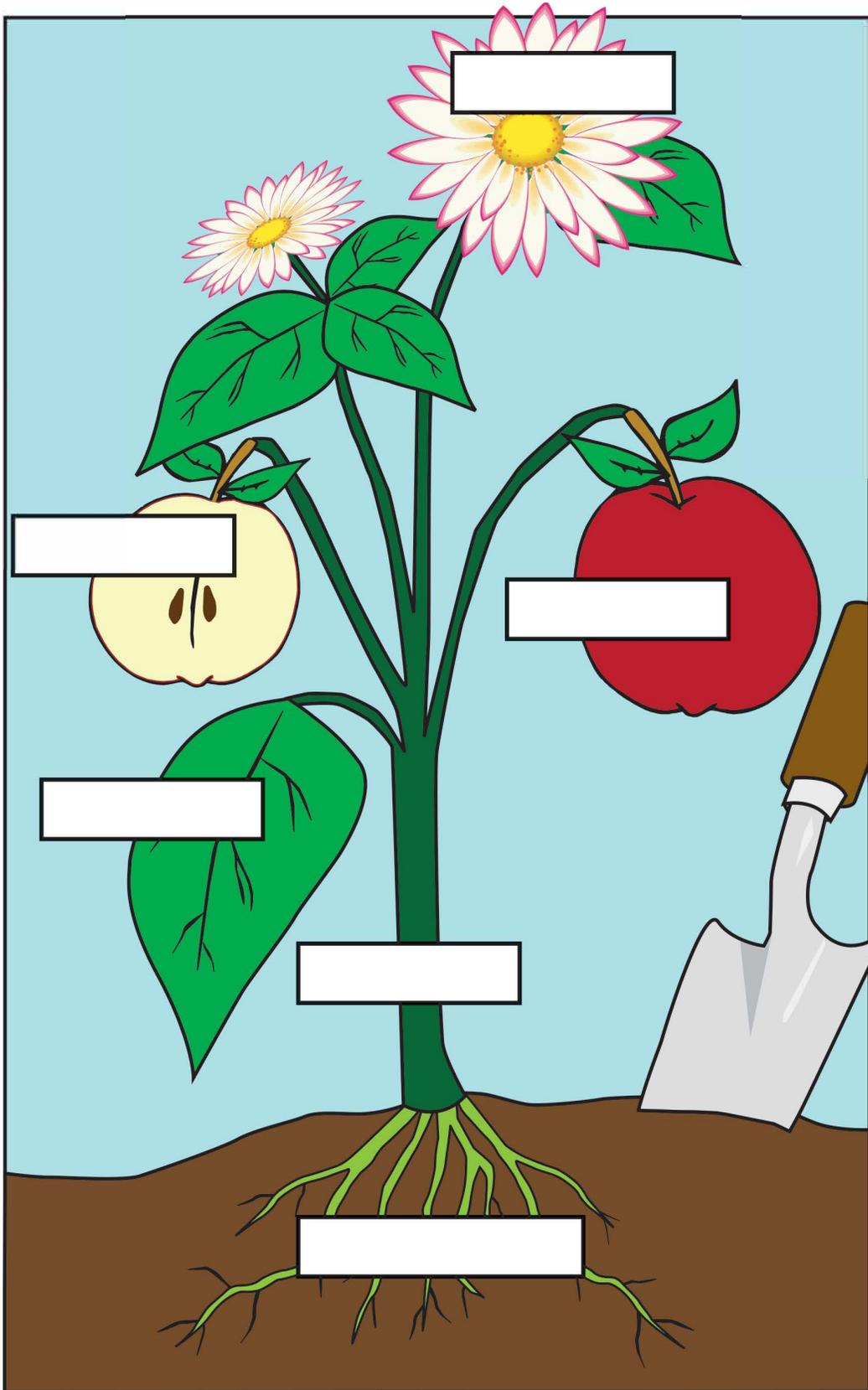


sunflower seeds



Identify Parts of the Plant We Eat

Name _____



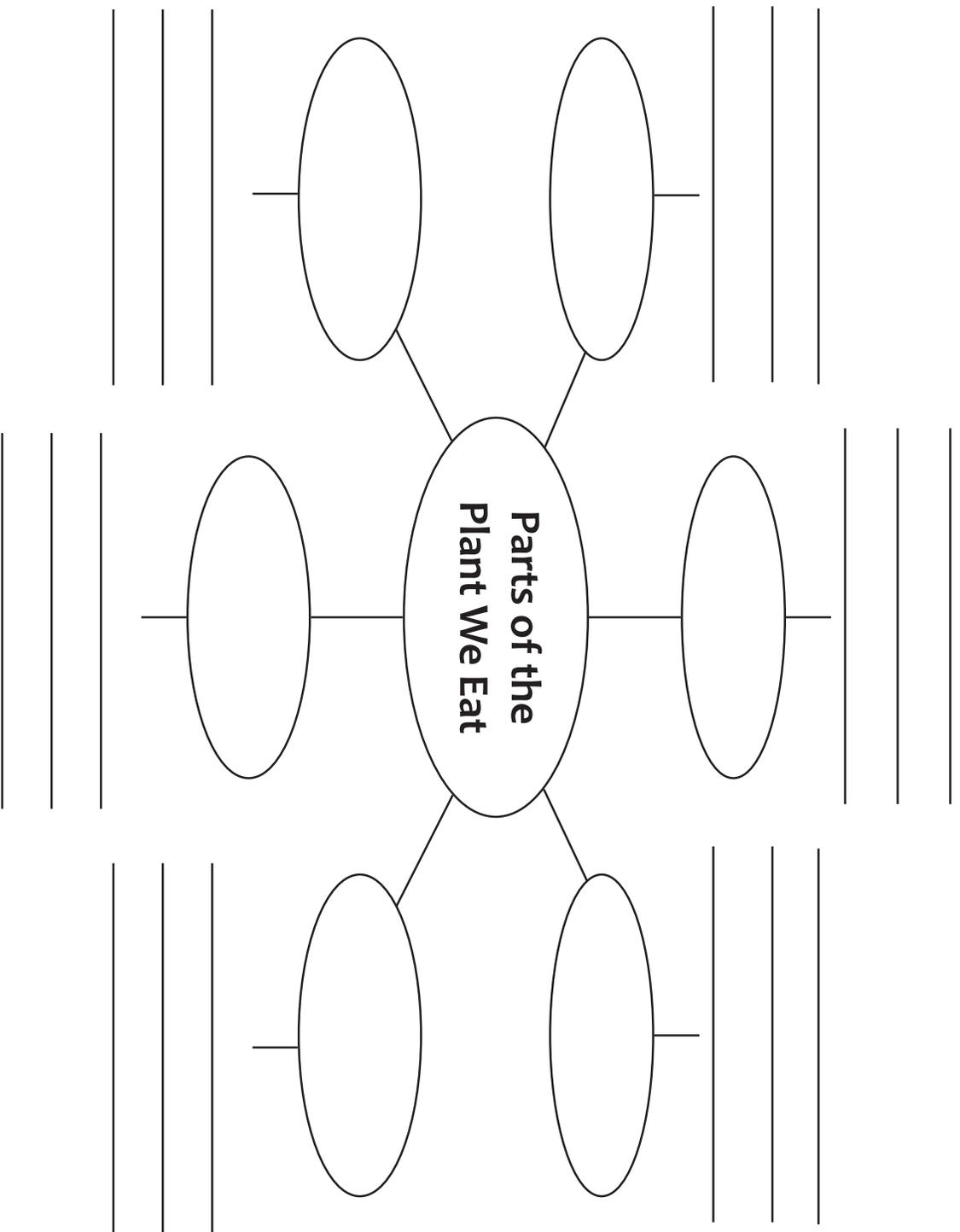
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Plant Parts Diagram



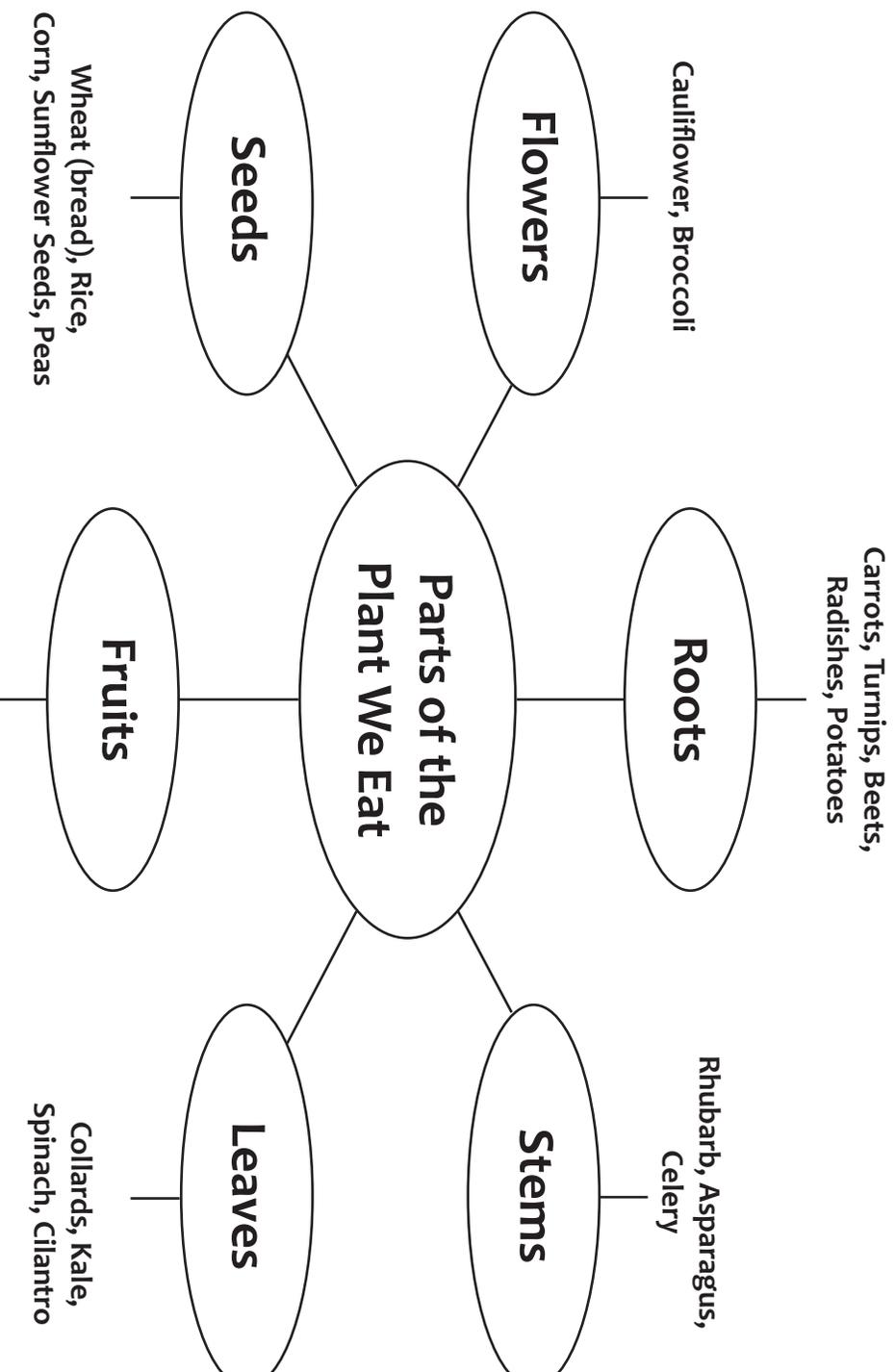
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Plant Parts Diagram

Answer Key



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Feed The Soil... and the Soil Will Feed You!

- 1. What Is Soil Made Of?**
- 2. How Do Different Soils Affect Our Plants?**
- 3. Soil Salad**
- 4. Garden Journal**

Feed the Soil... and the Soil Will Feed You

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Unit Introduction:

Plants and humans require many of the same things to survive, such as air, water, and space. This unit focuses on one unique plant necessity: soil. Students will learn that soil is a complex ecosystem made up of a mixture of living and non-living components. The “Soil Shake-Up” activity will reveal the different particle sizes that are mixed together in garden soil, and a drainage experiment will show how these particles affect the movement of water and nutrients through the soil. Students are introduced to the idea that nutrients in our food originate in the soil, and that by taking care of the soil, they can help ensure that our plants grow to be healthy and nutritious. The unit includes a recipe for a healthy salad that includes ingredients to represent all of the important components of real soil!

Teacher Vocabulary:

1. What Is Soil Made Of?

Clay - the smallest particles making up the inorganic (non-living) mineral component of soil.

Ecosystem - a biological community of interacting organisms and their physical environment.

Nutrients - substances that provide nourishment needed for growth, repair, or metabolism. Plants obtain nutrients from the soil; humans obtain nutrients from their food.

Organic Matter - material that was once living that has died, decomposed, and become part of the soil.

Sand - the largest particles making up the inorganic mineral component of soil.

Silt - the mid-sized particles making up the inorganic mineral component of soil.

Soil - the outer crust of the Earth’s surface, consisting of inorganic mineral particles arising from weathered rock, and humus (decomposed organic matter), and serving as a growing medium for plants.

2. How Do Different Soils Affect Our Plants?

Drainage - the rate at which water travels through soil.

Soil Structure - a term describing how the different soil components are arranged around one another.

Soil Texture - the relative proportions of different particle sizes making up the inorganic mineral component of soil.

3. Soil Salad

Compost - a mixture of decaying organic matter, such as leaves or fruit and vegetable scraps, used to improve soil structure and provide nutrients.

Decomposition - the process by which organic matter breaks into smaller molecules that are available for use in the soil ecosystem. Decomposition is carried out by bacteria, fungi, protists, worms, and other organisms.

Linking to the Garden: (refer to pages 28 through 30 in the curriculum Introduction)

Schoolyear Programs

Recommended Month: November

Plant: None

Harvest: Lettuce and leafy greens for “Soil Salad”; any other vegetables that may still be available in your fall garden

Complimentary gardening activities: Pull out spent plants and make compost pile; cover garden soil with leaves or other mulch; sow cover crop seed

Growing Season Programs

Recommended Month: July

Plant:

Transplant (late July): Broccoli, cabbage, cauliflower, collards, kale

Direct seed (late July): Carrots

Harvest: Cucumbers, peppers, tomatoes and any other available vegetables for “Soil Salad” (send surplus home with students)

Complementary gardening activities: Pull out spent plants and make compost pile; mulch; work compost into fall vegetable beds as you plant, other general garden maintenance

Background:

Soil is a complex ecosystem consisting of inorganic mineral particles, organic matter (plant parts, bacteria, fungi, and other invertebrate fauna that are living, dead or decomposing), air, and water. The inorganic mineral component is derived primarily from weathered rock. Organic matter is derived from the decomposition of dead plant material (roots or materials on the surface), or can be added to the soil in the form of compost or organic mulches such as leaves and straw. Understanding your soil starts with a description of two basic properties: texture and structure.

Inorganic mineral particles, the portion of the soil from broken down rock, make up the biggest proportion of the soil. Soil texture refers to the relative proportion of different particle sizes making up the inorganic mineral component. These particles are classified as sand (the largest particles), silt (medium-sized particles), and clay (very fine particles). Soil texture affects how well water and nutrients are retained in the soil. Soil with large amounts of sand drains well but does not retain moisture or nutrients. On the other hand, soil with large amounts of clay holds moisture and nutrients, but can prevent moisture from penetrating deep into the soil, and can suffocate roots when rain water is not able to drain away. Heavy clay soils are also very difficult for plant roots to penetrate. The ideal soil texture is one that has a balanced mixture of sand, silt, and clay; this mixture is referred to as loam.

Soil structure refers to how all of the components of soil (mineral particles, organic matter, air and water) are arranged around one another. For example, if you have very little space between the solid components of the soil for water and air to move through, your soil structure would be described as compacted. You can improve soil structure by adding organic matter. However, it is very difficult to change soil texture.

Plants remove nutrients from the soil as they grow. If they are not replaced, the soil becomes infertile, and the garden will eventually stop yielding. Adding organic matter (compost, mulch, tree leaves, etc.) will replace these nutrients better than adding fertilizer. Synthetic fertilizers are formulated to provide the major nutrients plants need (nitrogen, phosphorous, and potassium), but organic matter, which is derived from decomposed plant material, contains all of the minor or trace nutrients that were originally taken up by the plants that were composted. Adding organic matter also improves soil structure and drainage, while synthetic fertilizers do not.

State Curriculum Identifiers - Feed the Soil - Math Standards

Identifier	1st	2nd	3rd	4th	5th	Lesson #/S
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Standard 3.0 Measurement						
B.1.	a. Measure length of objects and pictures of objects to the nearest inch using a ruler.	a. Measure length of objects and pictures of objects using a ruler or tape measure to the nearest inch, centimeter, and foot.	a. Measure length of objects and pictures of objects using a ruler, a tape measure, a yardstick, or a meter stick.			1

State Curriculum Identifiers - Feed the Soil - Science Standards

Identifier	1st	2nd	3rd	4th	5th	Lesson #’s
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1.0 Skills and Processes:

A.1.	a. Describe what can be learned about things by just observing those things carefully and adding information by sometimes doing something to the things and noting what happens	a. Describe what can be learned about things by just observing those things carefully and adding information by sometimes doing something to the things and noting what happens	f. Identify possible reasons for differences in results from investigations including unexpected differences in the circumstances in which the investigation is carried out	f. Identify possible reasons for differences in results from investigations including unexpected differences in the circumstances in which the investigation is carried out	f. Identify possible reasons for differences in results from investigations including unexpected differences in the circumstances in which the investigation is carried out	1, 2
A.1.	b. Seek information through observation, exploration, and investigation	b. Seek information through observation, exploration, and investigation	b. Seek information through observation, exploration, and investigation			1, 2
A.1.	c. Use tools such as thermometers, magnifiers, rulers, or balances to extend their senses and gather data.	c. Use tools such as thermometers, magnifiers, rulers, or balances to extend their senses and gather data.	c. Use tools such as thermometers, magnifiers, rulers, or balances to extend their senses and gather data.			1
B.1.	a. Provide reasons for accepting or rejecting ideas examined	a. Provide reasons for accepting or rejecting ideas examined	a. Develop explanations using knowledge possessed and evidence from observations	a. Develop explanations using knowledge possessed and evidence from observations	Develop explanations using knowledge possessed and evidence from observations	1, 2
B.1.	b. Develop reasonable explanations for observations made	b. Develop reasonable explanations for observations made	b. Offer reasons for their findings and consider reasons suggested by others	b. Offer reasons for their findings and consider reasons suggested by others	b. Offer reasons for their findings and consider reasons suggested by others	1, 2
C.1.	a. Describe things as accurately as possible and compare observations with others	a. Describe things as accurately as possible and compare observations with others	d. Construct and share reasonable explanations for questions asked	d. Construct and share reasonable explanations for questions asked	d. Construct and share reasonable explanations for questions asked	1, 2
C.1.	d. Have opportunities to work with a team, share findings with others and recognize that all team members should reach their own conclusions about what the findings mean	d. Have opportunities to work with a team, share findings with others and recognize that all team members should reach their own conclusions about what the findings mean				2

Lesson #1: What is Soil Made of?

Time required: 40 minutes (classroom activities: 40 minutes)

Lesson Overview:

1. Students will begin to explore the very special role that soil plays in plant growth. They will conduct an experiment that will reveal that their garden or schoolyard soil is made up of different types of particles.
2. Students will use a graphic organizer to understand the components of soil.

Students will learn that:

- Soil provides plants with nutrients, support, and water.
- Soil contains mineral particles, organic matter, and living organisms.
- Different types of soil contain mineral particles of various sizes, organic matter, and organisms in different proportions.

Gather

- Hand trowel or shovel
- Clear glass jar with lid
- Clock or watch with a second hand
- Dry-erase marker or grease pencil

Setup:

- Retrieve a scoop of soil from the garden or schoolyard (remove grass, weeds, rocks, and other debris); enough to fill the glass jar halfway with soil.
NOTE: The activity in this lesson requires that you use “real” soil (from the ground), not potting soil.
- Make copies of the following handouts for each student:
 - “What is Soil Made of?”
 - “Soil Shakeup Experiment”
- Draw the diagram from the “What is Soil Made of?” handout on the board.
- If you don’t have a sink in your classroom, fill a container with water (enough to fill the glass jar).

Process:

Introduction (5 minutes)

1. Ask students to list what plants need in order to grow, such as sunlight, soil, water, space, and air.
2. Explain that plants need many of the same things that people do. However, soil is the one special thing that plants need that humans do not.

Engagement (10 minutes)

Discussion Questions

1. What is soil?
2. Why do plants need soil?
3. What is soil made of?
4. Is soil living or non-living?
5. Is all soil the same?

Key Points

1. Soil covers the Earth’s surface and provides a place for plants to grow. Soil is the scientific word for dirt.
2. Soil keeps plants anchored and upright, and provides moisture and nutrients to the roots.
3. Soil is a mixture of many different ingredients, both living and non-living.
4. There are many different types of soil, but all soils in Maryland have the same basic ingredients.

Activity (25 minutes)

SUMMARY OF ACTIVITIES

1. The class will complete an activity that will reveal that their garden soil is made up of a mixture of different particle sizes. You will shake up a jar of soil and water and allow the soil to settle out. The particles settle at different speeds, depending on their size. Once all the soil has settled, they can observe the layers of sand, silt, and clay that were previously mixed together in the soil.
2. The students will work with the teacher to complete the “What is Soil Made of?” handout. This graphic organizer will help the students visualize the different components that make up soil. The students will learn that soils from different places all have the same ingredients, but they differ in the proportion of those ingredients.

Activity Process #1 (10 minutes) “Soil Shake Up Experiment”

1. Display the jar containing the soil and tell students where it came from.
2. Tell students that soil is made from many different ingredients mixed together, and this experiment will help us separate those ingredients so we can see them.
3. Explain that you will fill the jar with water, shake it up, and observe what happens when the soil is allowed to settle.

4. Pass out the “Soil Shakeup Experiment” handout.
5. Ask students to predict what will happen. Have them record their hypotheses on the handout.
6. Remind students that a hypothesis is an educated guess about what will occur with our experiment. Have students record their hypothesis. You may need to guide students in coming up with some possible hypotheses, such as:
 - The soil will settle and look the same as before it was shaken.
 - The soil will not settle and will remain mixed with the water.
 - The soil will settle and look different than before it was shaken.
7. Remind students that an observation is a record of what happened in the experiment, and a conclusion indicates whether or not the hypothesis was correct. They will make observations and draw conclusions after the soil has settled overnight.
8. Leave the jar undisturbed to continue settling while you move on to the next activity.

NOTE: The soil will settle out in layers because it is made up of different “ingredients” that sink at different speeds. They will learn what these ingredients are during the next activity.

Activity Process #2 (15 minutes) “What is Soil Made Of?” handout

1. Pass out the “What is Soil Made Of?” handout.
2. Explain that this diagram will help us understand what soil is made of. Soil is made of both living and non-living things.
3. Ask students if they know another word that is sometimes used for soil.
4. Explain that the word “dirt” can be used to describe the non-living part of the soil. Scientists call this the inorganic mineral component of the soil. This is the “main ingredient” in soil: little particles that have been formed from rocks that have broken down into tiny pieces.
5. Write the word “dirt” in the bubble in the bottom center of the diagram on the board, and have the students do the same on their handouts.
6. Explain that “dirt” is non-living, but soil also contains living things. Ask students what the living portion of the soil is made of.
7. Tell students that earthworms, bacteria, insects, and fungi are living things that are part of the soil ecosystem. Share with students that there are 1 billion microorganisms in an amount of soil equal to the size of your fingertip.
8. Fill in one of the bubbles to the left or right of the central line with the word “critters” or “animals”.

9. Explain that animals aren't the only living things in the soil. Roots, leaves, and other parts of plants are left behind in the soil when they die. These plant parts break down, or decompose, and become part of the soil. The term "organic matter" refers to things that were once living that decompose and become part of the soil. Organic matter provides nutrients to plants.
10. Write "organic matter" in one of the remaining bubbles.
11. Point out that there are two bubbles remaining. In between the dirt, critters, and organic matter in the soil are spaces. These spaces are important because they make room for two things that plant roots need.
12. Students are to guess what the last two components are.
13. Write "air" and "water" in the remaining bubbles.
14. SAY:

These bubbles represent the five main ingredients of soil. However, we can further break-down the category of "dirt." Remember that the "dirt" component of soil is made from rocks that have broken down into tiny pieces. However, not all of these pieces are the same size. Soil scientists classify these particles into three main categories based on their size. Sand particles are the largest particles, clay particles are the smallest, and silt particles are medium-sized.

15. Write these three words (sand, silt, and clay) under the corresponding particle sizes.
16. Direct the students' attention to the jar. Remind them that this experiment was to help us see the different ingredients that are mixed together in soil, because different sized particles sink at different speeds.
17. Ask students to guess, which one of the three particles just named makes up the bottom layer of soil that settled out quickly. Have them explain their guess.
18. SAY:

The sand particles settled to the bottom the fastest because they are the largest. Silt will sink at a medium speed, and clay will take the longest to settle. Because of this, we should be able to see the different layers of particles once everything settles.

19. SAY:

We have just learned that soil is made of a mixture of different ingredients. If I gave each of you the same set of ingredients needed to make bread, would everyone's bread turn out the same? What else would you need to know?

20. Guide students in coming to the conclusion that the amount of different ingredients is important to the recipe.

21. SAY:

Just like different breads have different amounts of the same ingredients, different soils have different amounts of the ingredients shown on our diagram. The proportion of the different “ingredients” present in a soil sample determines what type of soil we have. This affects how our plants grow.

22. Explain that once all of the soil settles in the jar, they will be able to see the proportions of sand, silt, and clay in the soil. The sand will have already settled, but the silt and clay are smaller particles and therefore settle more slowly.

23. Have students record their initial observations on their Soil Shakeup Experiment handout. Collect and save handouts for use in the next lesson.

24. Leave the jar undisturbed over night to allow the experiment to finish.

Reserve a time to revisit the results of this activity as part of lesson #2.

Lesson #2: How Do Different Soils Affect Our Plants?

Time required: 30 minutes (classroom activities: 30 minutes)

Lesson Overview:

1. Students will draw conclusions from the “Soil Shakeup Experiment” started in Lesson #1 of this unit to understand the texture of their soil.
2. Students will conduct an experiment to determine how soil texture affects how water moves through soil.

Students will learn that:

- Soil provides plants with nutrients, support, and water.
- Different types of soil contain different amounts of sand, silt, clay, and organic matter.
- The amount of these different soil “ingredients” affects how quickly water and nutrients move through soil.

Gather

- The incomplete “Soil Shakeup Experiment” handouts from Lesson #1
- 4 one-quart-sized plastic containers (such as yogurt containers)
- Dried kidney beans (about 1 1/2 cups)
- Flour (about 1 1/2 cups)
- Sink or large plastic bin for catching water during experiment

Setup:

- Make copies of the “Soil Drainage Experiment” handout.
- Punch holes in the bottoms of two of the plastic containers using scissors or a pointed knife.
- Fill the plastic containers without holes with water.

Process:

Introduction (5 minutes)

1. Review the “ingredients” of soil: “dirt,” organic matter, critters, air, and water.
2. Review the fact that although all soils have the same basic ingredients, soils differ because they contain different amounts of the soil “ingredients.”

Engagement (5 minutes)

Discussion Questions

1. What part of the plant grows in the soil?
2. What is the role of the roots?

Key Points

1. Roots are the part of the plant that grows down into the soil.
2. Roots absorb water and nutrients from the soil, which are essential for plant growth.
3. Roots anchor the plant into the ground so it doesn't fall over.

Activity (20 minutes)

SUMMARY OF ACTIVITIES

1. Students will observe the jar from the “Soil Shakeup Experiment” that has settled overnight to determine the texture of the garden soil. This will prepare them to consider how soil affects plant growth.
2. You will use different sized food items to represent different sized particles that make up the mineral component of the soil. By pouring water over these particles, students will notice the differences in drainage time between the varying sized particles. The largest particles will allow water to drain through the fastest, and the smallest particles will drain the slowest.

Activity Process #1 (10 minutes) “Soil Shakeup Experiment” Conclusions

1. Ask the students to review the steps of the experiment from Lesson #1. Remind them of the various parts of the scientific method.
2. Ask students to describe the purpose of the experiment. What questions are they trying to answer with the experiment?
3. Call students’ attention to the jar from the previous lesson’s experiment. The water should be clear.
4. Without disturbing the jar, mark the top two layers that have formed in the soil. Ask students to recall what makes up each layer, and explain why they settle in those layers.
5. Students should recall that the bottom layer is sand (the largest particles). The middle layer is silt, and the top layer is clay. The layers form because larger particles settle faster than smaller particles.

6. Discuss the relative proportions of particle sizes in your soil. Have students record their observations on their experiment handout.
7. Remind students that the conclusion to the experiment is when the scientist decides whether their hypothesis was correct or not, and why.
8. Have students record their conclusions on the experiment handout.
9. SAY:

Our jar experiment showed us the layers of sand, silt, and clay in our soil. But remember that soil also includes other ingredients. The stuff floating on the top of the water is organic matter. Organic matter is the part of the soil that comes from living things that have died, decomposed, and turned back into soil. Soil that contains a lot of organic matter has a soft texture, dark color, and provides nutrients to plants. Plant roots can easily grow through it, and air and water can reach the roots. This is why we think of dark soil as being healthy.

10. If desired, use a ruler to measure the depths of each layer and the total depth of the soil. Use this information to calculate the percent composition of each soil component (divide the depth of each layer by the total depth of all layers combined, then multiply by 100). For example, if the sand layer is 2 inches thick, the silt layer, 1 inch, and the clay, $\frac{1}{2}$ inch, the total of all layers is 3.5 inches. The sand layer, therefore, is (2 divided by 3.5 = .57). Multiply by .57 by 100 = 57. Sand is 57% of the total solid depth.

Activity Process #2 (10 minutes) “Soil Drainage Experiment”

1. Explain that the class will complete another experiment that will show how different soil types affect how well roots are able to do their job of absorbing water and nutrients from the soil.
2. Display the kidney beans and the flour. Explain that these two things will represent different particle sizes in the soil. Ask students what they think the flour and the beans represent.
3. Explain that the kidney beans will represent sand, which are the largest soil particles, and the flour will represent clay, which are the smallest soil particles.
4. Show students the containers that have holes in the bottom. Explain that you will be placing a layer of each of the two different “soil particles” (beans and flour) in the two containers and pouring water over them to observe the speed at which water drains through.
5. (Pass out “Soil Drainage Experiment” handouts.) Remind students that a hypothesis is an educated guess about what will occur with our experiment. Have students record their hypothesis. You may need to guide students in coming up with some possible hypotheses, such as:
 - The water will drain through the flour faster than through the beans.
 - The water will drain through the beans faster than through the flour.
 - The water will drain through the beans and flour at the same speed.

6. Conduct experiment:

- Fill one of the containers that has holes in the bottom with about 1 1/2 cups of kidney beans. Put 1 1/2 cups of flour in the other container.
- Select students to assist in the experiment: one student to hold each of the drainage containers over the bin or sink; and one student to pour water into each of the drainage containers.
- Emphasize that this is an experiment, so we will pour the same amount of water over each type of “soil”, and try to pour it at the same speed.
- Instruct the students to rapidly pour the water over the two drainage containers while they are held over the sink or plastic bin.

7. Have students record their observations on the “Soil Drainage Experiment” handout.

8. Ask several students to explain the results they observed and whether their hypothesis was correct. Make sure students are given the opportunity to explain their own conclusions about how particle size affects soil drainage based on their own observations.

9. Explain that the kidney beans allowed the water to drain through the quickest because the large particles also leave large spaces between them, allowing water to drain through. The small particles in the flour lay right on top of one another and don’t allow water in between them. Remind students that the kidney beans represent sand, and flour represents clay. Ask students which type of soil particles allow water to drain through soil the fastest. Have them write their conclusions on their handouts stating whether their hypothesis was correct and explaining what they observed.

10. Remind students that soils contain different amounts of sand, silt, and clay. Ask them which particle type (sand, silt, or clay) they think is the best to have the most of. Have them explain their answers.

11. Explain that the best soil contains a mix of sand, silt, and clay. Ask the students to verbally brainstorm reasons for why this is. Discuss the following points:

12. SAY:

Sand allows water to drain down deep to the roots, and clay holds on to water and nutrients and keeps the roots moist when the weather is dry. Silt fills in between the sand and clay. Too much sand causes soil to dry out quickly; too much clay doesn’t allow water to penetrate to plant roots. A mix of all three is just right.

13. SAY:

Organic matter (things that were once living) is another important ingredient in soil. Ideal soil contains lots of organic matter because it provides nutrients to plant roots. Furthermore, it makes the soil loose and soft so that water can drain through it, but it also absorbs water like a sponge and stores it for when the weather is dry. No matter what kind of soil you have, adding organic matter to soil will help plants grow better.

Lesson #3: Soil Salad

Time required: 35 minutes (classroom activity: 20 minutes; food demo: 15 minutes)

Lesson Overview:

1. Students will discuss soil nutrients: their sources, their path from soil to plants to our bodies, and the importance of replenishing them.
2. Students will prepare a snack that will help them remember the different ingredients in soil.

Students will learn that:

- As they grow, fruits and vegetables use up nutrients from the soil.
- The vitamins and minerals in foods can be traced to minerals and nutrients in the soil.
- Growing and harvesting vegetables removes these minerals and nutrients from the soil.
- We can replace nutrients in the soil by adding organic matter, such as compost.

Gather

- Ingredients for “Soil Salad” recipe
- Equipment for “Soil Salad” recipe

Setup:

- Cook and chill brown rice.
- Draw the diagram from “What is Soil Made of?” handout (lesson #1) on the board, with bubbles filled in with names of soil components
- Make copies of the following handouts for each student:
 - “Soil Nutrients: Where did they come from? Where did they go?”
 - “Soil Salad” recipe.
- Harvest (or purchase), wash, and chop all vegetables for “Soil Salad,” reserving scraps for compost pile, if applicable.

Process:

Introduction (5 minutes)

1. Remind students that different-sized soil particles affect how quickly water drains through soil. Larger soil particles, such as sand, allow water to drain through more quickly than small particles, such as clay. Water that drains through the soil is soaked up by plant roots. Describe the feel of sand as gritty and rough, silt as smooth, and clay as sticky.

Engagement (5 minutes)

Discussion Questions

1. Besides water, what else does the soil provide that plant roots must absorb?
2. Why do plants need nutrients from the soil?
3. What part of the soil provides nutrients to plants?

Key Points

1. Plant roots absorb nutrients from the soil.
2. Plants need nutrients so they can grow and be healthy, just like our bodies need nutrients to grow and be healthy.
3. Organic matter is the best source of nutrients in the soil. Organic matter is made up of things that were once living that have decomposed to become part of the soil again. Nutrients contained in organic matter are released slowly into the soil over the growing season.

Activity (25 minutes)

SUMMARY OF ACTIVITIES

1. Students will use the “Soil Nutrients: Where did they come from? Where did they go?” handout to understand how nutrients move from the soil, into the plants, and finally, into our bodies. They will learn that soil nutrients must be replaced in order to have continued yields from the garden. Methods for replacing soil nutrients will be discussed.
2. The class will prepare a “Soil Salad” with healthy ingredients that represent all of the different components found in soil.

Activity Process #1 (10 minutes) “Soil Nutrients: Where did they come from? Where did they go?” handout.

1. Pass out “Soil Nutrients: Where did they come from? Where did they go?” handout. Direct students to the graphic at the top of the page.
2. ASK:

When a plant absorbs nutrients from the soil and we eat part of that plant, are those nutrients still in the soil?

3. Guide students in coming to the conclusion that the nutrients in vegetables move out of the soil, into the plants, and into our bodies.

4. Ask students what would happen to the nutrients in the soil if we kept growing and harvesting food every year for many years without adding anything to the soil.
5. Explain that the soil would become depleted of nutrients if we did not replace them and plants would stop growing!
6. Brainstorm ideas of things that we, as gardeners, can do so that the soil does not become depleted.
7. Direct students' attention to the graphic at the bottom of the page.
8. SAY:

Plants remove nutrients from the soil. However, if we take plant parts, such as scraps from our kitchen or leaves from our yard, and let them breakdown, or decompose, the nutrients that those plants soaked up from the soil while they were growing can be added back into the soil. This process of recycling plant nutrients is called composting. Composting is a way of making organic matter to add to our soil, and it helps keep our garden growing.

9. Explain that this is why worms are important garden friends: worms eat dead plant parts in the soil and turn it into organic matter that provides nutrients to the soil.

Activity Process #2 (15 minutes) “Soil Salad” Recipe

1. Explain to the class that you are all going to prepare a “Soil Salad”. The salad will not contain any soil, but each ingredient will represent a component of the soil. Students will be asked to guess which soil component each ingredient represents. If they get it right, they can add it to the salad.
2. NOTE: Remember to review with students the importance of clean hands when preparing food. Have all students wash their hands before they begin to handle the food. The curriculum introduction has a useful description of proper hand-washing techniques.
3. Display all ingredients: kidney beans, brown rice, salt, vinaigrette, vegetables, and shredded cheese.
4. Direct their attention to the “What is Soil Made Of?” diagram on the board, and remind them of the drainage experiment.
5. Ask the students what the kidney beans represented in the soil drainage experiment. They should recall that the beans represented sand because sand is the largest particles in the soil.
6. Select a student to open the can of beans, drain and rinse them, and add them to the mixing bowl.
7. Point out that although we used flour to represent the smallest particles in our drainage experiment, we aren’t going to use flour in our recipe because that wouldn’t taste good. Instead, we will use salt. Ask students to recall what the smallest particles in soil are called. They should recall that clay is the smallest particles in the soil.

Journal

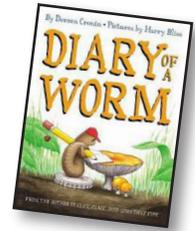
Time required: 20 minutes (classroom activities: 20 minutes)

Lesson Overview:

1. Students will write a creative written response to a prompt related to the content covered in the “Feed the Soil” unit.

Process:

1. Read the prompt aloud to your students. After answering any questions, allow them time to write a response in their Garden Journals.
2. Optional: Students in grades 1-3 may enjoy the book “Diary of a Worm” by Doreen Cronin as a complement to this activity. The book can be found in most libraries or book stores. Read the story after students write their journal entries.



Prompt:

In this journal activity, you will be asked to create the diary of a worm. Pretend you are an earthworm living in the garden soil. You have noticed that people seem to think that life in the soil is dark and dirty, and that you are gross and slimy. You are tired of it! In the space below, write a few paragraphs to inform people about what life in the soil is like. What goes on below the ground? What is your home like? How is the soil special? What special jobs do worms do?



Garden Journal

Name: _____

Pretend you are an earthworm living in the garden soil. You have noticed that people seem to think that life in the soil is dark and dirty, and that you are gross and slimy. You are tired of it! In the space below, **write a few paragraphs to inform** people about what life in the soil is like. What goes on below the ground? What is your home like? How is the soil special? What special jobs do worms do?

Handwriting lines for the journal entry.



Student Vocabulary

Clay - the smallest particles making up the non-living part of soil.

Compost - a mixture of decomposed organic matter, such as leaves or vegetable scraps, used to improve soil health and provide nutrients to plants.

Decomposition - the process by which living things that have died break down into smaller and smaller pieces and become part of the soil. Bacteria, fungi, worms, and other critters in the soil help dead plants decompose.

Drainage - the speed at which water travels through soil.

Nutrients - things needed by living organisms to grow and be healthy. Plants get their nutrients from the water, soil and air; humans get nutrients from their food and water.

Organic matter - once living plants and animals that have died, decomposed, and become part of the soil. Organic matter provides nutrients to the soil that help plants grow.

Sand - the largest particles making up the non-living part of soil.

Silt - the mid-sized particles making up the non-living part of soil.

Soil - the outer layer of the Earth's surface, made of non-living bits of rock, organic matter, air, and living things like bacteria and worms. Plants grow in soil because it provides them with water, nutrients, and support.



Soil Salad Recipe

This recipe for a healthy rice and bean salad is used to demonstrate the different components of soil. The beans and rice represent different sized soil particles (sand and silt); the vegetables represent organic matter (things that were once living); the dressing represents water; and the cheese represents worms! Healthy soils contain all of these things!

Makes 20 sample portions
Serves 6-8 as a side dish

Ingredients:

- 1 can kidney beans, drained and rinsed
- 1 cup cooked rice (preferably brown)
- ¼ teaspoon salt
- 1-2 carrots, washed, peeled, and shredded
- ½ can corn, drained
- ½ pint-sized container cherry tomatoes, washed and cut in half
- ½ green pepper, washed and chopped
- ⅓ tex-mex dressing
(store bought or homemade vinaigrette, recipe at right)
- ½ cup shredded low-fat cheese

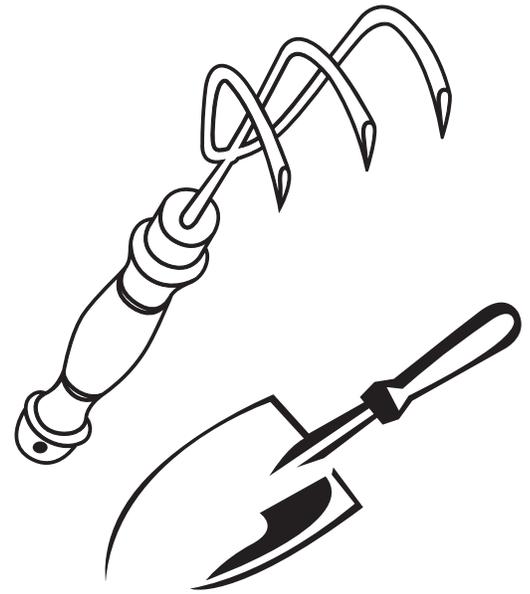
You will need:

- Can opener
- Collander
- Mixing bowl
- Serving spoon
- Measuring spoons

Directions:

1. Place beans, rice and vegetables in a large bowl.
2. Add dressing.
3. Mix thoroughly.
4. Top with cheese (if desired).

Cook's note: Vary your veggies! The vegetables suggested here are only suggestions. This recipe works with just about any vegetable that you might include in a salad. Experiment and enjoy!



Tex-Mex Vinaigrette

Ingredients:

- 1-2 Tablespoon red wine vinegar
- 1 ½ teaspoons mustard
- ½ teaspoon ground cumin
- Pinch cayenne (optional)
- 3 Tablespoons olive oil
- Salt and pepper to taste

Directions:

1. Place vinegar, mustard, and cumin in a bowl.
2. Whisk in olive oil.
3. Season with salt and pepper.
4. Taste and adjust seasonings.
5. Use in soil salad, or other salads.



**REMEMBER TO
WASH YOUR HANDS**



UNIVERSITY OF
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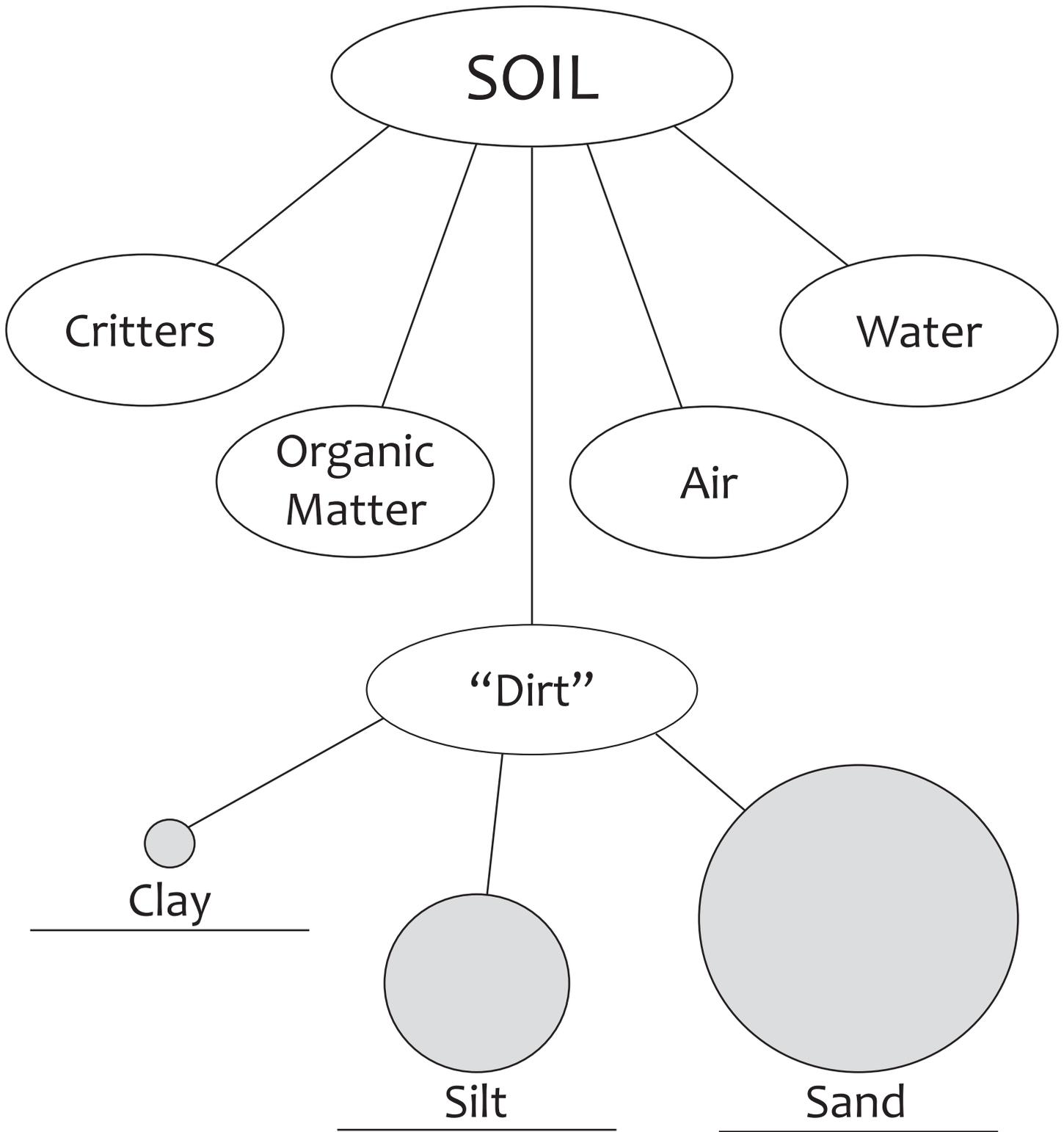


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What is Soil Made Of?

(Answer Key)



Variety: The Spice of Life!

1. Eat Your Colors
2. Garden Survivor
3. Who's Who in the Garden
4. Garden Journal

Unit Introduction:

While most students know that they should eat fruits and vegetables, the message gets a bit more complex when helping them select a diet that includes all of the many nutrients that fresh produce offers. Color is a useful tool in helping young people ensure they are getting a variety of vitamins, minerals, and phytochemicals from their fruit and vegetable selections. In this section, students learn the importance of variety in the diet as they play a game that demonstrates the link between colorful fruits and vegetables and nutrition. As they follow a recipe for a pasta salad and engage in additional games and classroom activities, the importance of variety is extended from the diet, to the garden, to our lifestyle.

Teacher Vocabulary:

1. Eat Your Colors

Minerals - elements that are nutrients essential to human nutrition. Examples of minerals that our body needs include calcium, magnesium, phosphorus, potassium, sodium, and iron.

Phytochemical - a bioactive plant substance not essential for human nutrition but considered to have a beneficial effect on human health, especially in disease prevention. Also called phytonutrient.

Variety - the quality of being made of many different elements, forms, kinds, or individuals.

Vitamin - nutrients essential in small quantities to human health. Vitamins must typically be supplied through diet. Examples include vitamins A, C, and E.

2. Garden Survivor

Drought - an extended period of abnormally dry weather that causes water shortages and crop damage.

Monoculture - a single crop planted on the same piece of land year after year.

Pest - an insect or disease that significantly damages garden plants by eating or otherwise destroying plant parts.

3. Who's Who in the Garden (No Vocabulary)

Linking to the Garden (refer to pages 28 through 30 in the curriculum Introduction)

Schoolyear Programs

Recommended Month: January

Plant: Nothing

Harvest: Nothing

Complimentary gardening activities: Use seed catalogues to select any special varieties you want to grow in the garden this year

Growing Season Programs

Recommended Month: September

Plant: Lettuce, radishes, leafy greens, spinach

Harvest: Red bell peppers or tomatoes for “Confetti Spaghetti;” If planted in mid- to late-summer, you may also have red cabbage, cauliflower, and carrots for the recipe

Complimentary gardening activities: General garden maintenance

Background:

MyPlate suggests that about half of our plate should be filled with fruits and vegetables at each meal. In addition to getting the right amount of these food groups, it is important to “vary your veggies” to ensure that your diet is rich in the different vitamins, minerals, and phytochemicals that vegetables provide. The color of produce is a good indicator of what vitamins are contained in fruits and vegetables, and by “eating a rainbow” we can ensure that we are getting a variety of vitamins and minerals in our diets. Abundant research has shown that consuming a diet rich in a variety of fresh fruits and vegetables decreases the risk of developing chronic diseases.

It is not uncommon for young children to dislike many fruits or vegetables. However, when they grow vegetables for themselves, many students are more willing to try vegetables that they thought they didn’t like. Even when considering a single type of vegetable growing your own vegetables can introduce many varieties that offer different tastes and textures than what we might find in the grocery store. Furthermore, homegrown produce is fresher and often tastes better than what we can buy at the store because varieties planted can be selected for flavor.

Growing a variety of vegetables provides the gardener with a variety of nutrients for good health. Planting many different types of plants in your garden also helps to protect the plants against diseases and pests. Pests and diseases tend to harm only one or a few types of plants. Additionally, different plants have different sensitivities to environmental fluctuations, such as drought or flooding. If a large area of one type of crop is planted (called a monoculture), a disease, pest, or environmental condition could wipe out an entire garden or farm. A diverse garden, however, is less likely to be entirely destroyed by a pest or weather event. Diseases often spread from host plant to host plant, so having mixed rows of different types of plants can slow the spread of a disease through the garden.

One of the most interesting links to point out is that the phytochemicals that plants produce to protect themselves from disease and damage also help fight disease in humans when we consume these foods. Growing a diversity of garden crops provides a diversity of phytochemicals. These phytochemicals not only provide our bodies with protection from a diversity of diseases, but they also protect the garden from a diversity of pests, diseases, and conditions!

State Curriculum Identifiers - Variety: The Spice of Life! - Reading/English Language Arts Standards

Identifier	1st	2nd	3rd	4th	5th	Lesson #s
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Standard 6.0 Listening

A.1.	a. Listen to the speaker	a. Listen to the speaker	a. Listen to the speaker	a. Listen to the speaker	a. Listen to the speaker	1, 2
A.1.	b. Respond appropriately to clarify and understand	c. Respond appropriately to clarify and understand	c. Respond appropriately to clarify and understand	c. Contribute relevant comments	c. Contribute relevant comments	1, 2
A.1.				d. Relate prior knowledge	d. Relate prior knowledge	1, 2, 3
A.2.	c. Demonstrate an understanding of what is heard by retelling, asking questions, and relating prior knowledge	c. Demonstrate an understanding of what is heard by retelling, asking questions, relating prior knowledge, and summarizing	c. Demonstrate an understanding of what is heard by retelling, asking questions, relating prior knowledge, and summarizing	c. Demonstrate an understanding of what is heard by retelling, asking questions, relating prior knowledge, and summarizing	c. Elaborate on the information and ideas presented	1, 2
A.2.	d. Follow a set of multi-step directions	d. Follow a set of multi-step directions	d. Follow a set of multi-step directions	d. Follow a set of multi-step directions	d. Draw conclusions based on the information presented	1, 2
A.2.	e. Listen carefully to expand and enrich vocabulary	e. Listen carefully to expand and enrich vocabulary	e. Listen carefully to expand and enrich vocabulary	e. Listen carefully to expand and enrich vocabulary		1, 2
A.2.	f. Make judgments based on information from the speaker	f. Make judgments based on information from the speaker	f. Make judgments based on information from the speaker	f. Make judgments based on information from the speaker		1, 2

State Curriculum Identifiers - Variety: The Spice of Life! - Science Standards continued

Identifier	1st	2nd	3rd	4th	5th	Lesson #s
3.0 Life Science:						
F.1.	c. Describe ways that animals and plants interact with each other and with their environment	c. Explain that organisms sometimes cause changes in their environments (i.e. squash bugs and carrot weevils)				2

State Curriculum Identifiers - Variety: The Spice of Life! - Health Standards

Identifier	1st	2nd	3rd	4th	5th	Lesson #s
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Standard 6.0 Nutrition and Fitness						
D.1.		a. List the six major nutrients: water; fat; vitamins; minerals; carbohydrates; and protein. (only discusses vitamins and minerals)	a. Describe the six major nutrients and how the body uses them (only discusses vitamins and minerals)	a. State how nutrients in foods contribute to health		1
D.1.		b. Name a food source for each nutrient		c. Summarize why the body needs vitamins and minerals		1
E.1.	a. Describe how food keeps the body healthy by maintaining strong bones, muscles, and teeth and preventing illness					1

Engagement (5 minutes)

Discussion Questions

1. What are some foods that are part of a healthy diet?
2. What are some of your favorite fruits and vegetables?
3. What makes fruits and vegetables so healthy?

Key Points

1. Fruits and vegetables are among the healthiest foods we eat.
2. A healthy diet includes food from all five food groups: fruits, vegetables, dairy, protein, and grains.
3. Fruits and vegetables provide us with vitamins, minerals, fiber and things called phytochemicals. Phytochemicals are things that protect us from illness.

Activity (50 minutes)

SUMMARY OF ACTIVITIES

1. Working in teams, students will “shop” for fruits and vegetables from the pictures taped to the board. Their selections will be guided by prompts which you will read aloud to them. Through this game, students learn the health benefits associated with fruits and vegetables, and observe that these benefits are linked to fruit and vegetable color.
2. Students will participate in creating a “Confetti Spaghetti” recipe made out of a variety of colorful vegetables and whole wheat pasta.

Activity Process #1 (20 minutes) “Take Your Pick” Game

1. Introduce the game:

Different fruits and vegetables contain different nutrients. We need lots of different nutrients in our diet to stay healthy. How do we know that we’re getting all of these wonderful vitamins, minerals, and phytochemicals in our diet? We’re going to play “Take Your Pick” to find out.

2. Break students into 5 groups.
3. Give each group one shopping bag.
4. Show students the pictures of produce at the front of the room.

5. Explain game:

- Each group will shop for their fruits and vegetables for the week.
- Each group must choose which fruits and vegetables they want to buy based on the statement that is read.
- After the statement is read, one person from the group will come up and choose one item from the board and put it in their grocery bag.
- The student will then return to their seat and pass the bag to the next person in their group.
- Group members will take turns so that everyone in the class has a chance to pick a fruit or vegetable.

6. Play the game using the following statements:

a. You've decided that you want to pursue a career as a pilot. You will need to have excellent vision in order to be a pilot. You just learned that vitamin A helps maintain good vision, especially night vision. Choose either cantaloupe, winter squash, sweet potatoes, carrots or apricots since they are all good sources of Vitamin A.

b. Friday night is pizza night at your house. Some of your favorite toppings are red peppers, tomatoes, and red onion, which is great because these vegetables help your body fight cancer! Choose tomatoes, red peppers, or red onion to put in your bag.

c. Your mom asked you to buy some greens. You're not sure what kind she wants and there are many different types to choose from! Hopefully she won't mind which one you choose because you just heard that most leafy green vegetables help build strong bones and maintain your vision! Choose one type of leafy green to put in your bag.

d. You remember that your mom sometimes stir-fries greens with garlic and onions. This is one of your favorite dishes, so maybe she will make it if you buy one of the ingredients. You also heard that these foods are good for your heart. Choose either garlic or onions to put in your bag.

e. You just read that purple grapes, blackberries, blueberries, plums, and raisins are good for your memory. You have a test next week so you want to buy one of these to pack in your lunch. Choose one of these fruits (grapes, blackberries, blueberries, plums, or raisins) to put in your bag.

7. When the game is complete, have students look at the contents of their bag and make an observation. Hopefully they will see that their bag contains a variety of colors of fruits and vegetables.

8. If they don't make the observation on their own, go back through the list and have them hold up the fruit or vegetable that they chose for each prompt.
9. Place each group of selections together on the board.
10. After going through the whole list, they should see that fruits and vegetables with similar nutrients have similar colors.
11. Discuss conclusions that can be drawn from this activity.

Key Points

1. Vitamins, minerals, and phytochemicals are linked to the colors of fruits and vegetables.
2. To get a variety of vitamins, minerals, and phytochemicals, we just need to eat a variety of colors. That's why some people say we should "eat a rainbow".
3. Gardening allows you to plant a wider variety of fruits and vegetables than you might be able to find at the store.

12. Pass around seed catalogues or allow students to look at the websites of seed companies to observe the variety of shapes and colors available to plant in our garden.
13. Challenge the class to find pink carrots, purple beans, red lettuce, and orange tomatoes.

Activity Process #2 (30 minutes) "Confetti Spaghetti" Recipe

1. Explain that the class will make a recipe that includes a variety of colorful vegetables.
2. Distribute "Confetti Spaghetti" recipe.
3. NOTE: Remember to review with students the importance of clean hands when preparing food. Have all students wash their hands before they begin to handle the food. The curriculum introduction has a useful description of proper hand-washing techniques.
4. Have students identify each ingredient by color and recall the benefits of fruits and vegetables in that color group.
5. Students who give appropriate answers may add that ingredient to the bowl.
6. Finish assembling "Confetti Spaghetti" pasta salad.
7. Encourage students to share the "Confetti Spaghetti" recipe with their family.

Lesson #2: Garden Survivor

Time required: 25-40 minutes (classroom activities: 25-40 minutes)

Lesson Overview:

1. Through a game and discussion, students will learn and remember the importance of variety to a healthy diet, to a healthy garden, and to good taste!

Students will learn that:

- Fresh fruits and vegetables are an important part of a healthy diet.
- Eating a variety of fruits and vegetables ensures that we get a variety of nutrients in our diets.
- Gardening can provide us with a variety of different fruits and vegetables of every color.
- Growing a variety of fruits and vegetables is good for the garden, too!

Gather

- Pictures of garden conditions (provided as an attachment to this unit):
 - Drought
 - Tomato horn worm
 - Corn earworm
 - Frost
 - Flood
 - Squash bug
 - Heat
 - Carrot weevil
- Pencils or markers

Set-up:

- Make copies of “Garden Survivor Cards.” There are 6 different garden cards for each of two seasons. The cards are placed in order so that you can remove the packet of cards and make double-sided copies that can easily be distributed to students. Make enough sets of copies so that each student gets one card for each season (for example, if you have 24 students, make 4 sets of cards). Distribute the different cards to the students.

Process:

Introduction: (5 minutes)

1. Remind students of the “Take Your Pick” game that they played in Lesson #1 of this unit.
2. Discuss the conclusions from the game.

Engagement: (5 minutes)

Discussion Questions

1. Why are fruits and vegetables so good for us?
2. What should we remember about choosing fruits and vegetables for a healthy diet?

Key Points

1. Fruits and vegetables contain vitamins, minerals, and phytochemicals. These things provide our bodies with what they need to be healthy, and prevent us from getting sick.
2. When choosing fruits and vegetables, we should remember to eat a rainbow of colors. Different colored fruits and vegetables contain different types of nutrients. If we eat lots of different colors, we'll get many different nutrients to keep us healthy.

Activity: (15 minutes)

Summary of Activity

The students will play “Garden Survivor” where they will learn that a garden full of variety is not only healthy for us, but also for the survival of the garden itself. Students will learn that under certain environmental circumstances, some plants will thrive, some will only survive, and others will likely die. Growing a variety of plants will help ensure that we will always have some produce to harvest for the kitchen table.

Activity Process #1 (15 minutes) “Garden Survivor” Game

1. Explain that we are going to grow a variety of fruits and vegetables in our vegetable garden. We are going to learn that variety in the garden not only produces a healthy diet, but also a healthy garden.
2. SAY:

Just like some people are good at soccer and others are good at singing, plants also have different traits that make them “good at” surviving different conditions in their environment.

3. Ask students to brainstorm some conditions that plants need to be able to live through.
4. Discuss that plants need to be able to survive periods of excessive cold or heat, pests, disease, drought, flood, etc.

5. Introduce the game “Garden Survivor”. Explain that you will be passing out garden cards (like bingo cards) that show gardens with different crops planted in them. Explain that you will read aloud several paragraphs describing different environmental conditions, and the students will have to X out plants that do not survive. At the end, the entire class will observe which garden did the best.

6. Pass out “Garden Survivor” cards.

7. Season 1: As you read each statement below, hold up the corresponding picture from the “Pictures of Garden Conditions.”

a. This year there was a drought, which means there was very little rainfall. Lettuce cannot survive without moisture. If you have lettuce in your garden, X it out.

b. Oh no! There has been an outbreak of tomato hornworms. Just like its name says, this insect is a pest of tomato plants. If you have tomatoes in your garden, X them out.

c. It’s time to harvest corn, and you discover that every ear is infested with corn ear worms. You have to get rid of your entire crop! If you have corn in your garden, X it out.

d. Brrr! There was an early frost this year. Eggplant can’t take the cold. If you have eggplant in your garden, X them out.

e. Season over! Look at your card and count how many plants survived. Write this number in the blank at the bottom of the page.

8. Now direct students to look at the card labeled “Season 2”. Explain that a year has passed and each student has planted another garden and will get another chance to see if the garden survives. Read each of the following conditions aloud, holding up corresponding pictures of garden conditions:

a. Plants need water to grow, but too much water can ruin a crop. Your garden was just flooded by heavy rains. Potatoes, which grow underground, can rot if the soil is too wet. If you have potatoes in your garden, X them out.

b. Intruders! There has been an outbreak of squash bugs. Guess what crop this bug likes to eat... If you have summer squash growing in your garden, X it out.

c. Can you believe it? It is October and the weather is still hot, hot, hot! Broccoli likes cool weather, so it is planted in late summer for a fall harvest. But broccoli isn't going to make it in this year's heat. If you have broccoli in your garden, X it out.

d. Evil weevils! There has been an outbreak of carrot weevils! If you have carrots in your garden, X them out.

e. Season over! Look at your card and count how many plants survived. Write this number in the blank at the bottom of the page.

9. Survey the class to see how many crops each student had left in their garden at the end of each season.
10. Identify the gardens that did the best during the two seasons and display these at the front of the room.
11. Identify the gardens that did the worst during the two seasons and display these at the front of the room.
12. Discuss the following questions:

Discussion Questions

1. What are the characteristics of the gardens that had lots of plants survive and produce food?
2. What are the characteristics of the gardens that did not have any plants survive and produce food?
3. Which gardens provided the gardener with the healthiest diet?
4. What statements can you make about the benefits of having a variety of crops growing in the garden?

Key Points

1. The gardens that had the greatest variety of crops planted had the most plants survive and produce healthy foods for the gardener.
2. Monocultures, which are gardens or farms planted with only one type of fruit or vegetable, are in danger of being wiped out by a pest or weather event.
3. A diverse garden is a healthy garden and it provides a variety of foods for a healthy, diverse diet.

13. Point out that while monocultures may survive in some years, a gardener is always running the risk of losing an entire crop if planting only one, or a few, types of plants.

Activity Process #2 (15 minutes) “Garden Survivor” Game Extension (optional)

1. Have students “plant” their own gardens by making up their own cards. Have them draw a footprint of the garden and pictures for the different types of vegetables they wish to grow.
2. Make up new scenarios (or use the ones above) and replay the game to test if they’ve learned the advantages of planting a diverse garden.

Lesson #3: Who's Who in the Garden?

Time required: 25-45 minutes (classroom activities: 25-45 minutes)

Lesson Overview:

1. Students will complete a gardener's bio highlighting some of their interests and preferences.

Students will learn that:

- Gardening is one way of obtaining a variety of fresh fruits and vegetables.
- Gardening requires teamwork and cooperation.
- People have different skills, opinions, and preferences.
- If we work together, our variety of skills, opinions, and preferences can help us have a healthy, diverse garden.

Gather

- Stickers, colored pencils, markers, and other art supplies
- Button making machine and supplies, if available for completing "Gardener Badge"

Setup

- Make copies of the following handouts for each student:
 - "Who's Who in the Garden?"
 - "Gardener Badge" (optional)

Process:

Introduction: (5 minutes)

1. Review the conclusions from Lessons #1 and #2.
2. Remind students that variety is important in the diet because a diverse diet ensures that we are getting a variety of nutrients for good health. A diverse garden is also less likely to get wiped out by a single pest or weather event.

Engagement: (5 minutes)

Discussion Questions

1. What does the statement "Variety is the spice of life" mean to you?
2. How does having a variety of people in our class help our gardening and learning?

Key Points

1. Variety is important in many parts of life. We learned about the importance of variety in our diets and in the garden. Variety is also important in many other areas of our lives.
2. Our gardening class will need to work together and bring all of our different talents and skills to our gardening work. In other words, variety in our class will help us maintain a beautiful garden!

Activity (15-35 minutes) “Who’s Who in the Garden” and “Gardener Badge” handouts

Summary of Activity

1. Students will complete a handout on which they will highlight some of their unique personal qualities. Students may also have the opportunity to design a personalized button with their name and pictures of their favorite vegetables.

Activity Process

1. Pass out the “Who’s Who in the Garden?” handout and allow students time to complete it.
2. Give each student a “Gardener Badge” handout. Reinforce that the drawing must stay within the circle, that it must contain their name and that it should contain a picture of their favorite vegetable. If your school has access to a button making machine, create buttons for students to wear. Otherwise, badges may be laminated and creatively used or displayed in the classroom.
3. Collect completed gardener badge worksheets. Cut out the circles and make buttons, badges, or other creative uses, depending on the equipment you have available.

Journal

Time required: 20 minutes (classroom activities: 20 minutes)

Lesson Overview:

1. Students will write a creative written response to a prompt related to the content covered in the “Variety: The Spice of Life” Unit.

Process:

1. Read the prompt below aloud to your students. After answering any questions, allow them time to write a response in their Garden Journals.

Prompt:

You may have heard the expression “Variety is the spice of life.” By now you should understand that eating a variety of foods, especially fruits and vegetables, is a good way to ensure you are getting all the nutrients you need. You also learned that growing a variety of fruits and vegetables in the garden protects your garden from being destroyed by pests, disease, or bad weather. Variety also makes life more interesting!

We are going to experience growing a variety of healthy foods in our garden. We will use this experience to learn about plants, the environment, nutrition, and cooking. Think about what you would like to learn from our gardening lessons. In the space below, write two facts that you have learned so far. Then write at least two questions that you hope to have answered through our gardening activities.



Garden Journal

Name: _____

We are going to experience growing a variety of healthy foods in our garden. We will use this experience to learn about plants, the environment, nutrition, and cooking. Think about what you would like to learn from gardening class. In the space below, **write two facts** that you have learned so far. Then **write at least two questions** that you hope to have answered throughout our gardening activities.

Horizontal lines for writing.



Student Vocabulary

Drought - a long period of dry weather that causes water shortages and plant damage.

Monoculture - a single type of plant growing in a garden or farm year after year.

Pest - an insect or disease which damages garden plants by eating or destroying them.

Phytochemical - chemicals that plants produce that protect them from insects, diseases, and stress. When we eat fruits and vegetables, phytochemicals protect us from getting sick.

Variety - the quality of being made of many different elements, forms, kinds, or individuals.



Confetti Spaghetti Recipe

This healthy pasta salad is an example of a recipe containing fruits and vegetables from all five color groups. Remember that eating a variety of colorful fruits and vegetables is the best way to ensure you are getting a variety of vitamins, minerals, and other nutrients in your diet!

Makes 20 sample portions
Serves 8 as a main dish

Ingredients:

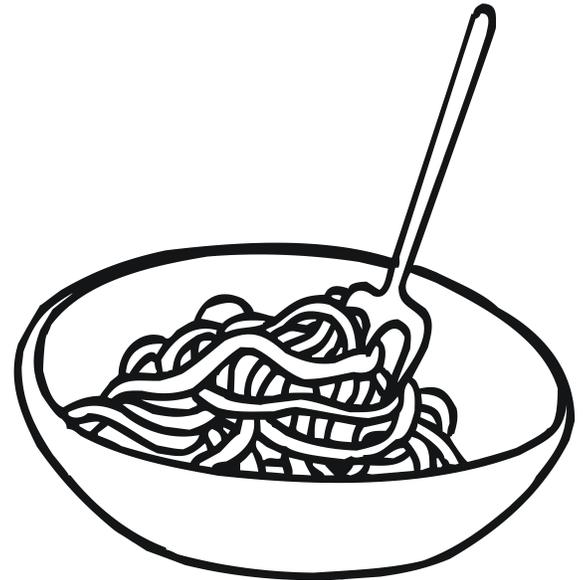
- 1 box whole-wheat pasta such as rotini, cooked and chilled
- 1 red bell pepper, washed and cut into chunks
- 1 carrot, washed and shredded
- 1 cup cauliflower (about ½ a small head), washed and cut into small pieces
- 1 cup baby spinach, washed
- 1 cup purple cabbage, washed and shredded (about ¼ of a head)
- 3 Tablespoons reduced-fat Italian dressing (or 2 Tablespoons oil and 1 Tablespoon vinegar)
- 2 Tablespoons part-skim shredded mozzarella cheese (optional)

You will need:

- Mixing Bowl
- Serving Spoon

Directions:

1. Place pasta and vegetables in a large mixing bowl.
2. Add dressing.
3. Mix thoroughly.
4. Dish into individual bowls and top with cheese (if desired).
5. Serve!



**REMEMBER TO
WASH YOUR HANDS**



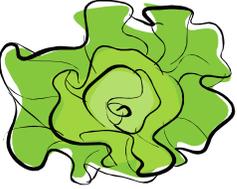
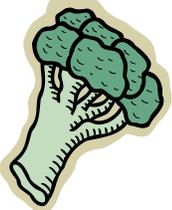
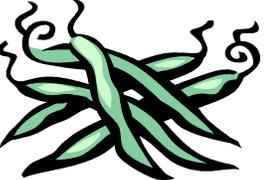
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Your Garden: Season 1

 Tomatoes	 Summer Squash	 Summer Squash	 Pumpkins
 Corn	 Potatoes	 Lettuce	 Pumpkins
 Carrots	 Carrots	 Kale	 Broccoli
 Eggplant	 Radishes	 Radishes	 Beans

Total number of plants surviving the season: _____



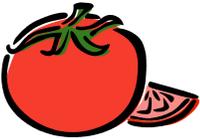
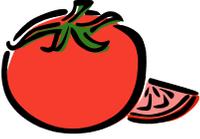
Your Garden: Season 2

 Carrots	 Carrots	 Summer Squash	 Summer Squash
 Carrots	 Carrots	 Summer Squash	 Summer Squash
 Carrots	 Carrots	 Summer Squash	 Summer Squash
 Eggplant	 Eggplant	 Summer Squash	 Summer Squash

Total number of plants surviving the season: _____



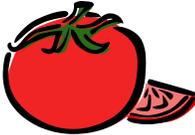
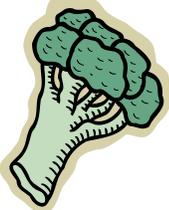
Your Garden: Season 1

 Tomatoes	 Tomatoes	 Tomatoes	 Tomatoes
 Tomatoes	 Tomatoes	 Tomatoes	 Tomatoes
 Tomatoes	 Tomatoes	 Tomatoes	 Tomatoes
 Tomatoes	 Tomatoes	 Tomatoes	 Tomatoes

Total number of plants surviving the season: _____



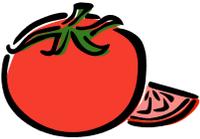
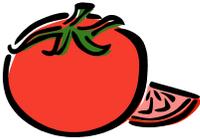
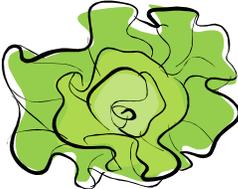
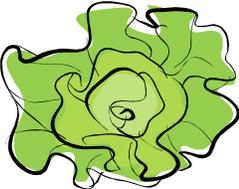
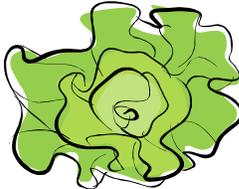
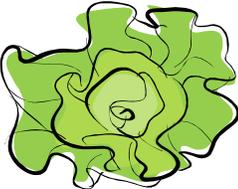
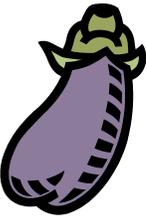
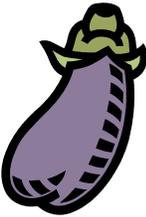
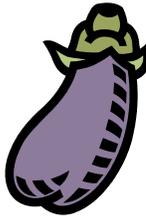
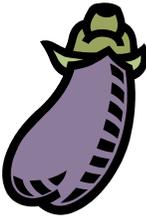
Your Garden: Season 2

 Tomatoes	 Tomatoes	 Summer Squash	 Pumpkins
 Corn	 Potatoes	 Lettuce	 Pumpkins
 Carrots	 Carrots	 Kale	 Broccoli
 Eggplant	 Radishes	 Radishes	 Beans

Total number of plants surviving the season: _____



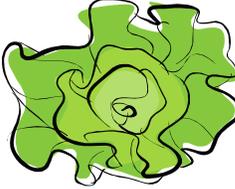
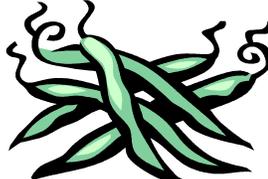
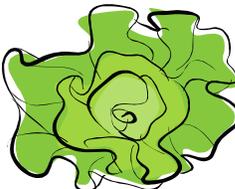
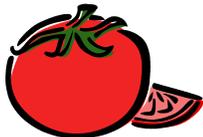
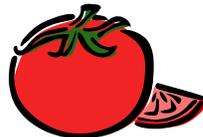
Your Garden: Season 1

			
Tomatoes	Tomatoes	Tomatoes	Tomatoes
			
Potatoes	Potatoes	Potatoes	Potatoes
			
Lettuce	Lettuce	Lettuce	Lettuce
			
Eggplant	Eggplant	Eggplant	Eggplant

Total number of plants surviving the season: _____



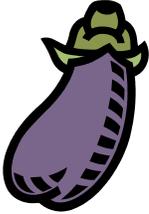
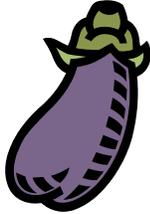
Your Garden: Season 2

			
Summer Squash	Summer Squash	Summer Squash	Beans
			
Potatoes	Potatoes	Lettuce	Beans
			
Carrots	Carrots	Lettuce	Radishes
			
Tomatoes	Tomatoes	Tomatoes	Radishes

Total number of plants surviving the season: _____



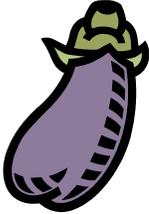
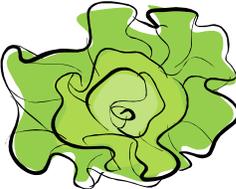
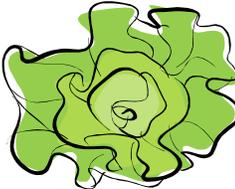
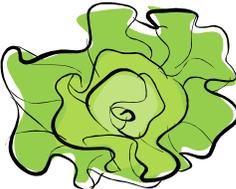
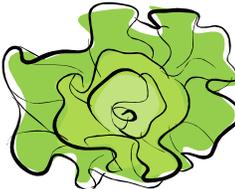
Your Garden: Season 1

 Eggplant	 Eggplant	 Eggplant	 Beans
 Eggplant	 Eggplant	 Eggplant	 Summer Squash
 Eggplant	 Eggplant	 Eggplant	 Broccoli
 Eggplant	 Eggplant	 Eggplant	 Pumpkins

Total number of plants surviving the season: _____



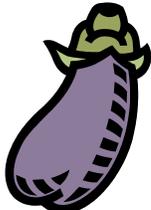
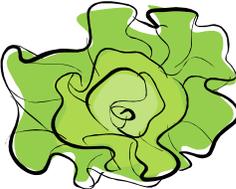
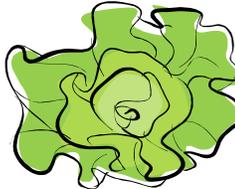
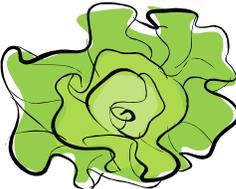
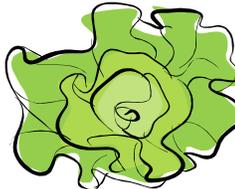
Your Garden: Season 1

 Eggplant	 Eggplant	 Tomatoes	 Tomatoes
 Eggplant	 Eggplant	 Tomatoes	 Tomatoes
 Eggplant	 Eggplant	 Lettuce	 Lettuce
 Eggplant	 Eggplant	 Lettuce	 Lettuce

Total number of plants surviving the season: _____



Your Garden: Season 1

 Carrot	 Carrot	 Tomatoes	 Tomatoes
 Potato	 Potato	 Tomatoes	 Tomatoes
 Eggplant	 Eggplant	 Lettuce	 Lettuce
 Eggplant	 Eggplant	 Lettuce	 Lettuce

Total number of plants surviving the season: _____





Drought





Early Frost





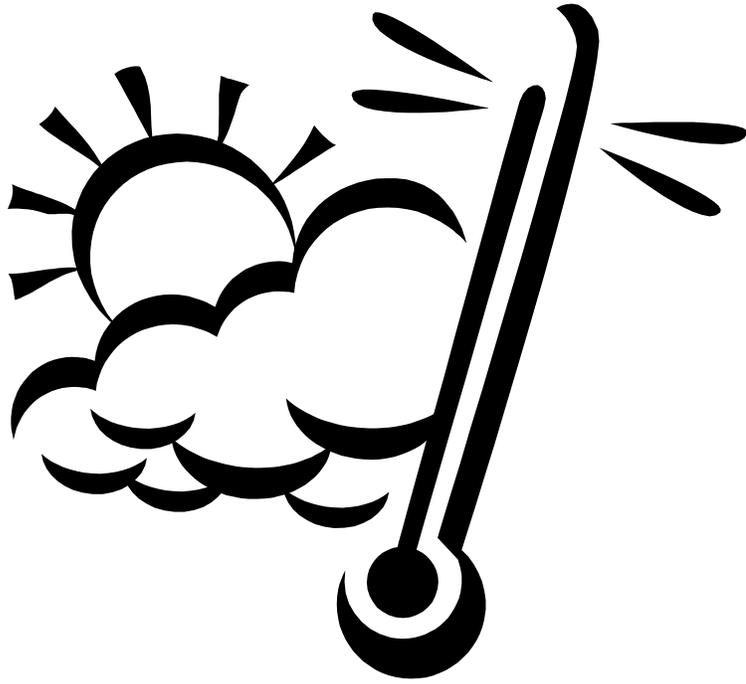
Too Much Rain





Squash Bug





Too Hot!



Plan Your Planting

1. Gimme Some Space!
2. What's On the Menu?
3. Garden on a Plate
4. Garden Journal

Plan Your Planting

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Unit Introduction:

Getting a garden off on the right foot requires knowledge of how and when to plant your chosen crops. Creating a garden plan, which includes making a planting schedule and deciding where to plant different crops, will improve your chances of success. In this unit, students complete an experiment illustrating that plants have minimum space requirements in order to grow. They will also use charts to create a planting schedule that will help ensure that their crops are planted during the time of year when they grow best.

Teacher Vocabulary:

1. Gimme Some Space!

Crowding - the condition of not having enough space to optimally grow and thrive.

Seed - a small, unformed plant encased in a seed coat and containing an energy source.

Thinning - the process of removing extra seedlings from a planted area so that the remaining plants have adequate room to grow and mature. Thinning is best done by snipping extra plants with scissors, since pulling them from the soil may disturb the roots of the plants that remain in the soil.

2. What's On the Menu?

Preference - the liking of some thing or condition more than another.

Season - in temperate zones, one of the four natural divisions of the year (spring, summer, fall, and winter). Each season is characterized by specific weather conditions.

Table - an orderly display of data arranged in columns and rows.

3. Garden on a Plate (No Vocabulary)

State Curriculum Identifiers - Plan Your Planting - Reading/English Language Arts Standards

Identifier	1st	2nd	3rd	4th	5th	Lesson #s
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Standard 2.0 Comprehension of Informational Text						
A.2.	b. Use graphic aids	b. Use graphic aids	b. Use graphic aids such as illustrations and pictures, photographs, drawings, sketches, cartoons, maps (key, scale, legend), graphs, charts/tables, and diagrams	b. Use graphic aids such as illustrations and pictures, photographs, drawings, sketches, cartoons, maps (key, scale, legend, graphs, charts/tables, and diagrams, other graphic aids encountered in informational texts	b. Use graphic aids such as illustrations and pictures, photographs, drawings, sketches, cartoons, maps (key, scale, legend, graphs, charts/tables, and diagrams, other graphic aids encountered in informational texts	2

Standard 6.0 Listening						
A.1.	a. Attend to the speaker	a. Attend to the speaker	a. Attend to the speaker	a. Attend to the speaker	a. Attend to the speaker	1, 2, 3
A.1.	b. Respond appropriately to clarify and understand	c. Respond appropriately to clarify and understand	c. Respond appropriately to clarify and understand	c. Contribute relevant comments	c. Contribute relevant comments	1, 2, 3
A.1.				d. Relate prior knowledge	d. Relate prior knowledge	1, 2, 3
A.2.	c. Demonstrate an understanding of what is heard by retelling, asking questions, and relating prior knowledge	c. Demonstrate an understanding of what is heard by retelling, asking questions, relating prior knowledge, and summarizing	c. Demonstrate an understanding of what is heard by retelling, asking questions, relating prior knowledge, and summarizing	c. Demonstrate an understanding of what is heard by retelling, asking questions, relating prior knowledge, and summarizing	c. Elaborate on the information and ideas presented	1, 2
A.2.	d. Follow a set of multi-step directions	d. Follow a set of multi-step directions	d. Follow a set of multi-step directions	d. Follow a set of multi-step directions	d. Draw conclusions based on the information presented	1, 2, 3
A.2.	e. Listen carefully to expand and enrich vocabulary	e. Listen carefully to expand and enrich vocabulary	e. Listen carefully to expand and enrich vocabulary	e. Listen carefully to expand and enrich vocabulary		1, 2
A.2.	f. Make judgments based on information from the speaker	f. Make judgments based on information from the speaker	f. Make judgments based on information from the speaker	f. Make judgments based on information from the speaker		1, 2

State Curriculum Identifiers - Plan Your Planting - Science Standards

Identifier	1st	2nd	3rd	4th	5th	Lesson #s
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1.0 Skills and Processes:

A.1.	b. Seek information through observation, exploration, and investigation	b. Seek information through observation, exploration, and investigation	e. Follow directions carefully and keep accurate records of one's work in order to compare data gathered	e. Follow directions carefully and keep accurate records of one's work in order to compare data gathered	e. Follow directions carefully and keep accurate records of one's work in order to compare data gathered	1, 2, 3
B.1.			d. Keep a notebook that describes observations made, carefully distinguishes actual observations from ideas and speculations about what was observed, and is understandable weeks or months later	d. Keep a notebook that describes observations made, carefully distinguishes actual observations from ideas and speculations about what was observed, and is understandable weeks or months later	d. Keep a notebook that describes observations made, carefully distinguishes actual observations from ideas and speculations about what was observed, and is understandable weeks or months later	1, 2, 3
D.3.	a. Explain that a model of something is different from the real thing but can be used to learn something about the real thing	a. Explain that a model of something is different from the real thing but can be used to learn something about the real thing	a. Explain that a model is a simplified imitation of something and that a model's value lies in suggesting how the thing modeled works	a. Explain that a model is a simplified imitation of something and that a model's value lies in suggesting how the thing modeled works	a. Explain that a model is a simplified imitation of something and that a model's value lies in suggesting how the thing modeled works	3

3.0 Life Science:

C.1.		a. Investigate and describe that seeds change and grow into plants				1, 2, 3
E.1.			c. Observe and record the sequence of changes that occur to plants and animals that die and decay	c. Identify the things that are essential for plants to grow and survive		1, 2, 3
F.1.		b. Explain that organisms live in habitats that provide their basic needs				1, 2, 3

State Curriculum Identifiers - Plan Your Planting - Health Standards

Identifier	1st	2nd	3rd	4th	5th	Lesson #/s
Standard 6.0 Nutrition and Fitness						
F.1.		a. Classify foods into groups according to MyPyramid				3

3. SAY:

In order for us to grow a variety of healthy fruits and vegetables, we are going to need to learn a lot about gardening. We want to grow many different vegetables, which means we need to know something about what makes each plant grow best. This will help us plan for a successful gardening season.

Engagement (5 minutes)**Discussion Questions**

1. What are some things that you like? What are some things that you don't like?
2. What are some things that you are good at? What are some things you are not so good at?
3. Do plants "like" certain things and not others?
4. Are plants "good at" certain things and not others?

Key Points

1. No two people are alike; everyone has different preferences, strengths, and weaknesses.
2. Just like people, plants have different preferences, strengths and weaknesses: some plants "like" cool weather, others "like" hot weather. Some plants can survive a long time without water, while others dry up quickly.
3. This information affects how we plant our vegetables in the garden. We have to learn what our different plants "like" and "don't like", so that we know how to help them grow best.

Activity (20 minutes) "Radish Spacing Experiment"**SUMMARY OF ACTIVITY**

Students will set up an experiment in which radish seeds are planted at three different densities. They will make a hypothesis about how the distance between seeds will affect how well the plants will grow. Students will continue to make observations over the next three weeks about how the radish seedlings in the various pots grow differently.

If everything goes as expected, the overcrowded seedlings will grow long and stringy and may eventually die, whereas the well-spaced radish seedlings will form true leaves, and may even start to form a swollen root (the edible part of radishes).

Activity Process (20 minutes)

1. Review what plants need in order to grow, including sunlight, water, soil, air, and space.
2. Ask students what would happen if a plant did not get enough sunlight or water.
3. Emphasize that the plant would not be able to grow, or would eventually die if it was unable to get these important necessities.
4. Explain that today's experiment will show what happens if we don't give plants enough space.
5. Pass out the "Radish Spacing Experiment Instructions" handout.
6. Work with students to set up the experiment according to the instructions. Depending on the availability of materials, you can either set up one experiment (3 containers) for the whole class, or break the students into groups and have each group set up an experiment of their own (3 containers per group).
7. Pass out the "Seed Spacing Experiment" handout.
8. Remind students that a hypothesis is an educated guess about what will occur with our experiment. Have students record their hypothesis. You may need to guide students in coming up with some possible hypotheses, such as:
 - The radishes that are closely spaced will grow biggest.
 - The radishes that are spread out will grow biggest.
 - All of the radishes will grow the same.
9. Remind students that an observation is a record of what happened in the experiment, and a conclusion indicates whether or not the hypothesis was correct. They will make observations and draw conclusions in about a week.
10. Place containers in the sunniest window in the classroom.
11. Be sure to keep the soil moist by watering very gently using the cups with holes punched in the bottom to sprinkle water on the soil, or using a mister bottle if available.
12. Collect "Seed Spacing Experiment" handouts and save for making observations.
13. Check plants daily to water and to observe their growth over the next three weeks.
14. Each week, have students record their observations (you will be reminded to do this at the beginning of each of the next two lessons in this unit).
15. It should become clear that the crowded seeds grow longer and stringier than the plants that were given more room.

3. Give each student a paper plate. This represents the area that will contain a garden bed.
4. Explain that they will create their garden beds using lumber, or wood. They will use carrot sticks to represent lumber.
5. Pass out four carrot sticks to each student and have them make a rectangle with the sticks on the plate.
6. Now they must fill their garden bed with soil. They are going to use refried beans or hummus to represent soil.
7. Give each student a dollop of beans or hummus to represent soil. They should spread the beans or hummus around in the garden bed using a plastic spoon.
8. Explain that they will need to place seeds in the soil. Corn kernels are the seeds of the corn plant, so they will use corn to represent seeds in their garden. Remind students that the seeds have to be planted at the right spacing in order to grow. Tell them to plant their seeds in the garden so that they are each about a half inch apart. (They may need to look at a ruler to be able to estimate a half inch).
9. Place spoonfuls of corn kernels on each student's plate, and allow them to sow seeds in their gardens and check their spacing.
10. Now they will spread mulch around their plants. Explain that mulch can be made from straw, leaves, or other materials that help keep the soil moist and prevent weeds from growing. They will use shredded cheese to represent mulch.
11. Place a small pile of shredded cheese on each students' plate and allow students to spread "mulch" over their garden.
12. Emphasize that if they take care of their garden, those seeds will grow into vegetables! Give students broccoli florets to place in their gardens as plants. Have them place some broccoli florets in their garden to show that they've grown. Try to make it look like a real garden bed!
13. Salsa can be used as an additional condiment to "water" the garden.
14. SAY:

The best part about growing a garden is that after all the hard work of constructing, planting, and tending it, we can eat the results! Dip the veggies in the beans or hummus and eat them!

15. As students eat, review the nutritional composition of the snack: it contains items from the vegetable group, dairy group, and protein group, making it a balanced snack.
16. Encourage students to take this "Garden-on-a-Plate" recipe home to share with their family.

Journal

Time required: 20 minutes (classroom activities: 20 minutes)

Lesson Overview:

1. Students will write a creative written response to a prompt related to the content covered in the “Plan Your Planting” Unit.

Process:

1. Read the prompt aloud to your students. After answering any questions, allow them time to write a response in their Garden Journals.

Prompt:

Thanks to all of our hard work, the garden will soon start providing lots of tasty, healthy food! With that comes a new challenge: What are we going to do with all of this food?! We will use some of it in our nutrition and cooking lessons, but not all of it. Think about how we might use the extra veggies and with whom we might share them. Think about ways we can use our garden produce to share nutrition knowledge with others. Write a few paragraphs describing your ideas for what we can do with our extra vegetables, with whom you would like to share them, and gardening and nutrition facts you would like them to know.



Student Vocabulary

Crowding - the condition of not having enough space to comfortably grow or move.

Preference - the liking of something or some condition more than another.

Season - one of the four periods of the year (spring, summer, fall, and winter) with specific weather conditions.

Seed - the part of the plant that, when planted and given warmth and water, can grow into a baby plant.



Seed Spacing Experiment

The Scientific Method

Today's Date _____

My Name _____

Hypothesis:

Observations:

After 1 week:
After 2 weeks:
After 3 weeks:

Conclusion:



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Spring Planting Table for Central Maryland

Dates are approximate. Consult the document “Planting Dates for Vegetable Crops in Maryland” in the Appendix to learn whether direct seeding or transplanting is recommended.

Crop (months to harvest from planting date)	March	April	May	June
Broccoli (2 months)		█		
Carrots (2 months)		█	█	
Kale and Collards (1 months)		█		
Lettuce (1 1/2 months)	█	█	█	
Peas (2 months)	█	█		
Radishes (1 month)	█	█	█	
Spinach (1 1/2 months)	█	█		

Based on information from University of Maryland Extension



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Seed Magic

1. Seed Dissection
2. Energy Storage in Seeds
3. After Germination: Photosynthesis
4. Garden Journal

Seed Magic

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Journal

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Student Vocabulary

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Seed Salad Recipe

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Confetti Bean Salsa, optional recipe

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Teacher Handouts

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Seeds that we Eat

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Seed Anatomy and Germination

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Seed Germination Experiment

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Seeds in the Light vs. Seeds in the Dark Experiment

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Unit Introduction:

When planted in a garden, the tiny seed transforms into a living plant, with only the addition of water. While it may seem like magic, important science and nutrition lessons can be taught through germinating seeds. In this section, students dissect a seed to learn its three different parts, set up two experiments that show that a seed has energy and nutrition stored inside of it, and follow the recipe for a “Seed Salad”, a healthy snack made of seeds.

Teacher Vocabulary:

1. Seed Dissection

Germination - the process by which a dormant seed becomes a growing plant. When a seed absorbs water, it triggers a reaction that causes it to break dormancy and sprout roots and leaves.

2. Energy Storage in Seeds (No Vocabulary)

3. After Germination: Photosynthesis

Chlorophyll - the pigment in green plants that is responsible for photosynthesis and turning sunlight into energy.

Linking to the Garden: (refer to pages 28 through 30 in the curriculum Introduction)

Schoolyear Programs

Recommended Month: March

Plant:

Start transplants indoors: Broccoli, collards, kale

Transplant (mid-March): Cabbage, lettuce

Direct seed (mid-March): Peas, radishes, spinach

Harvest: None

Complementary gardening activities: Work compost or other organic matter into the garden a week or two before planting, build trellis for peas

Growing Season Programs

Recommended Month: March

(see Schoolyear Program)

Background:

Most familiar garden vegetables are annual angiosperms, meaning they are flowering plants that complete their life cycle in a single season. They begin as seeds, grow into mature plants, flower, and bear fruit. The fruit contains seeds for the next generation. For some plants, such as tomatoes and peppers, the seeds are packaged in a familiar, edible fruit. For others, such as lettuce and other leafy green vegetables, the seeds are contained in fruits that are not eaten.

This series of lessons focuses on how plants are able to transform from dormant seeds into young plants and connects this knowledge to nutrition. Seeds are composed of a papery coating (the seed coat), the baby plant (the embryo), and stored energy (contained in the cotyledons or “seed leaves”). The energy storage provides the young plant with fuel to begin growing until it develops true leaves, at which point photosynthesis begins to provide the plant with energy. Even the experienced gardener can marvel at the amazing proficiency with which a plant provides for itself. Within one season, a single seed can produce a plant that bears many fruits, each fruit containing between one and hundreds of seeds!

When we eat seeds, the energy stored in them provides our bodies with energy and valuable nutrients. Common seeds that we eat include beans, nuts, and the edible seeds inside fruits such as cucumbers or cranberries. Seeds typically contain a mix of protein, carbohydrates, and healthy fats (in varying proportions), as well as micronutrients such as vitamin E. Rice, corn, and other grains are seeds as well; however, they are the seeds of grasses, rather than flowering plants. As with most foods, the less seeds are processed, the more nutrients they retain.

State Curriculum Identifiers - Seed Magic - Reading/English Language Arts Standards

Identifier	1st	2nd	3rd	4th	5th	Lesson #s
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Standard 4.0 Writing						
A.2.			b. Describe in prose and poetry by using sensory details and vivid language with active verbs and colorful adjectives	b. Describe in prose and poetry by using purposeful imagery and sensory details with active verbs and colorful adjectives		4

Standard 6.0 Listening						
A.1.	a. Attend to the speaker	a. Attend to the speaker	a. Attend to the speaker	a. Attend to the speaker	a. Attend to the speaker	1, 2
A.1.	b. Respond appropriately to clarify and understand	c. Respond appropriately to clarify and understand	c. Respond appropriately to clarify and understand	c. Contribute relevant comments	c. Contribute relevant comments	1, 2
A.1.				d. Relate prior knowledge	d. Relate prior knowledge	1, 2, 3
A.2.	c. Demonstrate an understanding of what is heard by retelling, asking questions, and relating prior knowledge	c. Demonstrate an understanding of what is heard by retelling, asking questions, relating prior knowledge, and summarizing	c. Demonstrate an understanding of what is heard by retelling, asking questions, relating prior knowledge, and summarizing	c. Demonstrate an understanding of what is heard by retelling, asking questions, relating prior knowledge, and summarizing	c. Elaborate on the information and ideas presented	1, 2
A.2.	d. Follow a set of multi-step directions	d. Follow a set of multi-step directions	d. Follow a set of multi-step directions	d. Follow a set of multi-step directions	d. Draw conclusions based on the information presented	1, 2
A.2.	e. Listen carefully to expand and enrich vocabulary	e. Listen carefully to expand and enrich vocabulary	e. Listen carefully to expand and enrich vocabulary	e. Listen carefully to expand and enrich vocabulary		1, 2
A.2.	f. Make judgments based on information from the speaker	f. Make judgments based on information from the speaker	f. Make judgments based on information from the speaker	f. Make judgments based on information from the speaker		1, 2

State Curriculum Identifiers - Seed Magic - Science Standards

Identifier	1st	2nd	3rd	4th	5th	Lesson #s
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1.0 Skills and Processes:

A.1.	b. Seek information through observation, exploration, and investigation	b. Seek information through observation, exploration, and investigation				1, 2, 3
A.1.			b. Select and use appropriate tools such as hand lens, rulers, scales, and thermometers to augment observations of objects, events and processes		b. Select and use appropriate tools such as hand lens, rulers, scales, and thermometers to augment observations of objects, events and processes	1
A.1.	c. Use tools such as thermometers, magnifiers, rulers, or balances to extend their sense and gather data	c. Use tools such as thermometers, magnifiers, rulers, or balances to extend their sense and gather data				1
A.1.			f. Identify possible reasons for differences in results from investigations including unexpected differences in the circumstances in which the investigation is carried out		f. Identify possible reasons for differences in results from investigations including unexpected differences in the circumstances in which the investigation is carried out	2, 3
B.1.	b. Develop reasonable explanations for observations made	b. Develop reasonable explanations for observations made	a. Develop explanations using knowledge possessed and evidence from observations		a. Develop explanations using knowledge possessed and evidence from observations	1, 2, 3
B.1.			b. Offer reasons for their findings and consider reasons suggested by others		b. Offer reasons for their findings and consider reasons suggested by others	1, 2, 3
B.1.			d. Keep a notebook that describes observations made		d. Keep a notebook that describes observations made	1, 2, 3
C.1.	a. Describe things as accurately as possible and compare observations with others	a. Describe things as accurately as possible and compare observations with others	d. Construct and share reasonable explanations for questions asked		d. Construct and share reasonable explanations for questions asked	1, 2, 3

State Curriculum Identifiers - Seed Magic - Science Standards continued

Identifier	1st	2nd	3rd	4th	5th	Lesson #/s
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1.0 Skills and Processes:

C.1.	d. Have opportunities to work with a team, share findings with others and recognize that all team members should reach their own conclusions about what the findings mean	d. Have opportunities to work with a team, share findings with others and recognize that all team members should reach their own conclusions about what the findings mean				1, 2, 3
C.1.			e. Recognize that doing science involves many different kinds of work	e. Recognize that doing science involves many different kinds of work	e. Recognize that doing science involves many different kinds of work	1

2.0 Earth/Space Science:

D.2.	a. Identify ways that the sun affects the earth including that the sun warms the earth and provides light					2
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3.0 Life Science:

A.1.	a. Use the senses and magnifying instruments to examine a variety of plants to describe external features and their functions					2, 3
E.1.				a. Classify the things that people and animals take into their bodies as food or not food		1, 3
E.1.					a. Identify the sun as the primary source of energy for all living organisms	2, 3
E.1.				c. Identify the things that are essential for plants to grow and survive		1, 3
F.1.				a. Identify and describe the interactions of organisms in their habitat including competition, beneficial interactions, and roles within food chains		1

Lesson #1: Seed Dissection

Time required: 40 minutes (classroom activities: 40 minutes)

Lesson Overview:

1. Students will dissect a bean to observe the parts of the seed that allow it to germinate, or start growing.
2. Students will set up an experiment that demonstrates that seeds use stored energy and nutrition to grow once they are planted.

Students will learn that:

- Seeds are one way that plants reproduce.
- Seeds contain energy and nutrition to help baby plants grow, and people get energy and nutrition when they eat seeds.
- There are three parts to a seed, the seed coat, the embryo, and the cotyledon or “backpack” of stored energy.

Gather

- Dry beans such as black, kidney, lima, or pinto (enough for one for each student)
- 4 sandwich-size re-sealable plastic bags
- 4 paper towels

Setup:

- Make copies of the following handouts for each student:
 - “Seeds That We Eat”
 - “Seed Anatomy and Germination”
 - “Seed Germination Experiment”
- Soak beans overnight.
- If you don’t have a sink in your classroom, fill a container with enough water to dampen the paper towels.

Process:

Introduction (5 minutes)

1. Explain that gardeners need to understand how seeds start to grow and what they need to do in order to help seeds start growing.

2. Discuss what plants use seeds for.
3. Explain that a seed actually contains a tiny plant inside of it. When a seed sprouts, the new plant is called a seedling.

Engagement (5 minutes)

Discussion Questions

1. Can you think of any foods that we eat that are seeds?
2. What are some of your favorite seeds to eat?

Key Points

1. Seeds contain energy and nutrients, which help them grow into new plants. Some seeds are also healthy foods for humans.
2. Examples of seeds that we eat include popcorn, peanuts, rice, corn, beans, and sunflower seeds.

Activity (30 minutes)

SUMMARY OF ACTIVITIES

1. During the first activity, students will perform a dissection of a bean. This activity will allow them to identify all three parts of the seed and review their function.
2. In the second activity, students will prepare an experiment to determine if a seed will grow best when planted whole or when only its embryo is planted. Students will set up the experiment and form hypotheses in this lesson, and make observations and conclusions in later lessons.

Activity Process #1 (15 minutes) “Seed Dissection Experiment”

1. Pass out the handout “Seeds That We Eat!” to show students images of some of the common foods they eat that are actually seeds.

2. ASK:

What do these seeds contain that makes them good foods for humans?

3. Discuss that the energy and nutrients that seeds contain help seeds grow into plants, and also make them good food for humans.

4. Explain that they will be completing a seed dissection that will help them understand how seeds work and why we eat some seeds.
5. Explain that a dissection is the process of dividing something up into its parts so that its function can be understood.
6. Pass out one soaked bean and one paper plate to each student.
7. Pass out the “Seed Anatomy and Germination” handout.
8. Demonstrate a seed dissection using a soaked bean. Teach the students to use their fingernails to peel off the seed coat, then to separate the two cotyledons. The embryo is attached to one of the cotyledons.
9. Assist students in dissecting their seed and identifying the three parts. Have students place all seed parts on the paper plate so that they don’t lose their embryo (it will be used again later in the lesson). Have them use the handout to identify the embryonic leaves and embryonic root.
10. Explain the functions of these three main parts: the seed coat protects the seed, the cotyledon is the “backpack” of food that the seed uses when it starts to grow, and the embryo is the actual baby plant before it starts to grow. Reinforce the idea that the cotyledon, or the “backpack” of food and nutrients, is what the seed uses for energy, and that when we eat seeds we get that same supply of energy and nutrients.
11. Reinforce this idea by reminding students that the bean we just dissected is not only a seed, but a healthy food that gives us energy. Much of the energy and nutrition we get when we eat beans comes from the cotyledons of the seed.
12. Lead a discussion about what students learned from the seed dissection:

Discussion Questions

1. What do mature plants need to grow and be healthy?
2. What do seeds need in order to start growing?
3. Why don’t seeds need sunlight or soil in order to start growing?

Key Points

1. Mature plants need sunlight, soil, air, water, and space.
2. Seeds only need moisture and warmth to germinate, or start growing.
3. Seeds have all of the energy and nutrition that they need to start growing stored inside the seed, so they don’t need sunlight for energy or soil for nutrition. (NOTE: these concepts will be reinforced in later lessons.)
4. A seed will eventually use up all of its stored energy. Once a seed grows leaves, it starts getting energy from the sun.

Activity Process #2 (15 minutes) “Seed Germination Experiment” Set Up

1. Explain that the class is going to set up an experiment to determine what grows best: a whole bean seed or just the seed embryo. Remember that the embryo is the part of the seed that becomes the baby plant. To do this, the class is going to put a whole bean seed, as well as an embryo taken from a seed, in a plastic baggie with a wet paper towel. The class will then let the seeds germinate and finish this experiment during the next lesson.
2. Break the class into four groups. Pass out one baggie and one paper towel to each group. Have students wet the paper towels, fold them, and place one in each baggie.
3. Have each of the groups pick their biggest intact embryo of the group (many embryos will have broken into two pieces during the dissection). Place the group’s biggest embryo into the plastic baggies on the wet paper towel.
4. Give each group one whole soaked bean. Have them place this bean in the baggie as well. After putting the seeds in the baggies, make sure that they are sealed.
5. After all four bags have a wet paper towel, an embryo, and a whole bean seed in it, allow students to mark their bag with a group name.
6. Pass out the “Seed Germination Experiment” handout.
7. Remind students that a hypothesis is an educated guess about what will occur with our experiment. Guide the students in developing the three possible hypotheses regarding the growth of the whole bean seed and the bean embryo. Students should choose one of the three possible hypotheses:
 - I. The whole bean seed will grow bigger than the embryo.
 - II. The embryo will grow bigger than the whole bean seed.
 - III. The embryo and whole bean seed will grow to the same size.
8. Have the students choose which hypothesis is their best guess and write it on their handout.
9. Explain that they will let the baggies sit for one week. After that week, they will complete the handout by writing down their observations and conclusions.
10. Remind students that an observation is a record of what happened in the experiment, and a conclusion indicates whether or not the hypothesis was correct.
11. Place the bags in a dark closet, simulating the underground. Make sure the handouts are collected so they can be used during the next lesson.

Lesson #2: Energy Storage in Seeds

Time required: 50 minutes (classroom activities: 50 minutes)

Lesson Overview:

1. Students will make observations and draw conclusions from “The Seed Germination Experiment” from Lesson #1 of this unit.
2. Students will set up another experiment exploring a seedling’s need for sunlight after it has sprouted.

Students will learn that:

- Seeds store a finite amount of energy inside of them.
- After the energy stored in the seed is used up, plants need sunlight to continue to grow.

Gather

- 4 sandwich size re-sealable plastic bags
- 4 paper towels
- 8 dry beans such as black, kidney, lima, or pinto.
- The incomplete “Seed Germination Experiment” handouts from Lesson #1.

Setup:

- Make copies of the “Seeds in the Light vs. Seeds in the Dark Experiment” handout.
- Soak beans overnight.
- If you don’t have a sink in your classroom, fill a container with enough water to dampen the paper towels.

Process:

Introduction (5 minutes)

1. Review the first steps of “The Seed Germination Experiment” from Lesson #1 with students. Remind them that the scientific method provides steps for formulating a question, making a hypothesis, conducting an experiment, making observations, and drawing conclusions.
2. Ask students to describe the purpose of the experiment. What questions are they trying to answer with the experiment?
3. Discuss the three hypotheses that were proposed in Lesson #1 regarding the growth of the embryo compared to the whole seed.

Engagement (5 minutes)**Discussion Questions**

1. Who thinks that the whole seed will have grown better than the embryo? Why?
2. Who thinks that the embryo will have grown better than the whole seed? Why?
3. Who thinks that they will have grown the same? Why?

Key Points

1. During an experiment, there are no bad hypotheses. Encourage students to support their opinions with previous experiences or knowledge.

Activity (40 minutes)**SUMMARY OF ACTIVITIES**

1. Students will draw conclusions from “The Seed Germination Experiment”. If everything goes as expected, they will conclude that the full bean was able to grow because it contained the “backpack” of stored energy, and the embryo did not.
2. Students will extend the concept learned in the first activity by beginning the “Light vs. Dark Experiment”. During this activity, students will hypothesize whether plants can continue to grow with or without light for an extended period of time.

Activity Process #1 (20 minutes) “The Seed Germination Experiment” Conclusion

1. Redistribute the “Seed Germination Experiment” handout. Discuss concepts from Lesson #1:

Questions

1. What is seed germination?
2. What does a seed need to germinate?
3. Where do seeds get their energy while starting to grow underground?

Key Points

1. Seed germination is the term used for when a seed sprouts, or starts growing.
2. Seeds only need water and warmth in order to germinate.
3. The cotyledon, or “backpack” of energy is the storage of nutrients that the seed uses to grow underground. Because of this storage, seeds do not need sunlight or soil in order to start growing.

2. Bring out the four bags containing the whole seeds and the embryos, and have the students make observations. They should observe that the whole bean seed has grown and that the embryo has not.
3. Have the students write on their handout their observations of what happened during the experiment. They should simply record their observations, or what they see, rather than attempt to explain why.
4. Discuss why the whole bean seed has grown and the embryo has not.
5. Students should conclude that the whole bean seed was able to use energy stored in its cotyledons, or “backpack” to start growing. The embryo alone did not have this storage of energy, and therefore did not grow.
6. Have the students write their conclusion, which should state whether or not their hypothesis was correct. The students should also include an explanation for what they observed.

Activity Process #2 (20 minutes) “Light vs. Dark Experiment”

1. Ask students to imagine how they would feel if they only ate breakfast, but then didn’t eat again for the rest of the day. Would they have energy all day?
2. Explain that our food gives us energy. Seeds store energy that allows them to start growing. However, that energy doesn’t last forever. Eventually, it is all used up.
3. Tell the students that they will be conducting a second experiment to see if healthy seedlings can grow as a seed’s energy store is used up. The class will again germinate seeds in plastic bags, and place some in the dark and some in the sunlight.
4. Pass out the “Seeds in the Light vs. Seeds in the Dark Experiment” handout to each student and divide the students into four groups. Give each group a plastic bag, a wet paper towel, and a soaked bean. Have them assemble the bags as they did in the first experiment (using only whole beans, not separated embryos).
5. Seal the bags. Place two bags in a dark closet, and two on a sunny windowsill. If you don’t have a windowsill, the lighting in your room will be enough for the experiment.

6. Have the students generate the possible outcomes of the experiment, stated as hypotheses:
 - I. The seeds in the light will grow better than the seeds in the dark.
 - II. The seeds in the dark will grow better than the seeds in the light.
 - III. They both will grow the same.
7. Have the students choose the hypothesis that is their best guess and write it on their handout.
8. Ask what observations the class will make to decide which germinated seeds will have grown better. Answers should include size and color.
9. Collect the handouts so they can be used during the next lesson.

Lesson #3: After Germination: Photosynthesis

Time required: 50 minutes (classroom activity: 30 minutes; food demo: 20 minutes)

Lesson Overview:

1. Students will make observations of their seedlings kept in the light and the dark.
2. Students will enjoy a snack composed of a selection of seeds that we eat.

Students will learn that:

- The energy and nutrition stored in seeds eventually runs out and needs to be replaced by energy from sunlight and nutrition from soil.
- Plants use sunlight to make energy.
- There are many foods that we eat that are seeds.

Setup:

- Make copies of the “Seed Salad” recipe.
- “Confetti Bean Salsa” optional recipe.

Gather

- 1 sandwich size plastic bag or plastic cup per student
- Ingredients for “Seed Salad” recipe
- Equipment for “Seed Salad” recipe
- The incomplete “Seeds in the Light vs. Seeds in the Dark Experiment” handouts from Lesson #2

Process:

Introduction (5 minutes)

1. Review the first steps of the experiment from Lesson #2 with students. Ask them to restate the purpose of the experiment.
2. Discuss that the purpose of the experiment was to determine whether the seedlings would continue to grow in the dark or if they need light to grow.

Engagement (5 minutes)

Discussion Questions

1. Who thinks that the seeds in the dark will have grown better than the seeds in the light? Why?
2. Who thinks that the seeds in the light will have grown better than the seeds in the dark? Why?
3. Who thinks that they grew the same? Why?

Key Points

1. During an experiment, there are no bad hypotheses. The important thing is to support opinions with previous experience or knowledge.

Activity (40 minutes)**SUMMARY OF ACTIVITIES**

1. Students will conclude the “Light vs. Dark Experiment” by making observations and drawing conclusions about the different conditions of seeds sprouted in the light versus the dark.
2. The class will participate in making a fun snack full of nutrients from different kinds of seeds.

Activity Process #1 (20 minutes) “Seeds in the Light vs. Seeds in the Dark Experiment”

1. Have students take out their “Seeds in the Light vs. Seeds in the Dark Experiment” handout.
2. Show the students the four bags with seeds in them, and have them write down their observations. Discuss their observations.

Discussion Questions

1. How do the seedlings look different?
2. What about the way the seedlings look tells you something about their health?
3. What were the colors of the seedlings after they grew in the light versus the dark?

Key Points

1. The seeds that sprouted in the sunlight should have taken on a green color; those in the dark should have stayed white.
2. The green color of the seedlings indicates they are a healthy young plant.
3. Explain that while the seeds in the light were healthier, they now need nutrition from the soil. The energy and nutrients stored in the seeds are running out, and now they need soil to survive. When we plant our seeds in our garden, it is important that there is a lot of sunlight for energy in addition to healthy soil for nutrients.

3. Have the students re-read their hypothesis and write their conclusions. Remind them that their conclusion should indicate whether their hypothesis was proven or disproven, and should explain their observations.

4. Remind students that when we eat seeds, the seeds provide us with energy and nutrients just as they provide energy and nutrients to a germinating and growing plant.

Activity Process #2 (20 minutes) “Seed Salad” Recipe

1. Ask students to recall some foods that are seeds.
2. Tell the students that they are going to make a mix of three different seeds, and then mix these seed foods with a dried fruit that also has a seeds inside it.
3. NOTE: Remember to review with students the importance of clean hands when preparing food. Have all students wash their hands before they begin to handle the food. The curriculum introduction has a useful description of proper hand-washing techniques.
4. Start by popping the popcorn, reminding them that popcorn is a type of corn, which is a seed. (NOTE: If using an electric skillet, keep the heat on high the whole time to ensure the popcorn pops--the thermostats on the skillets prevent them from getting as hot as a stovetop burner.)
5. After the popcorn is popped, place it in the large mixing bowl, have the students measure the remaining ingredients, and put them all into the bowl.
6. Mix and serve in plastic cups or sandwich size bags.
7. Encourage students to share the “Seed Salad” recipe with their family.

Journal

Time Required: 20 minutes (classroom activities: 20 minutes)

Lesson Overview:

1. Students will write a creative written response to a prompt related to the content covered in the “Seed Magic” Unit.

Process:

1. Read the prompt aloud to your students. After answering any questions, allow them time to write a response in their Garden Journals.

Prompt:

We learned that seeds store energy to allow new plants to start to grow, and that when you eat seeds, they provide our bodies with energy. Make a list of some of the foods that you eat that are seeds. Then make a list of things you like to do that require energy.

Now choose an item from each list and see if you can write a funny poem that links eating seeds to physical activity. Here is an example:

Jason likes munching on popcorn,
On the way to his school track meet.
He has no need for an energy bar,
Because seeds make him fast on his feet.



Student Vocabulary

Dissect - to divide something into its separate parts to learn how they work.

Germinate -the process of a seed starting to grow into a young plant.

Photosynthesis - the process that plants use to get energy from the sun to grow and be healthy.

Reproduce - to make a new one of something.

Seed - the part of the plant that, when planted and given warmth and water, can grow into a baby plant.

Seedling - a baby plant.



Seed Salad Recipe

This is a tasty snack that lets you experience how much energy is inside seeds.

Makes 20 sample portions
Serves 6 as a snack

Ingredients:

½ cup unpopped popcorn and 2 Tablespoons vegetable oil
[or for microwave option, substitute unpopped popcorn and vegetable oil with 1 bag (plain or light) microwave popcorn]

½ teaspoon salt (or to taste)
1 cup sunflower seeds
1 cup pumpkin seeds (if available)
1 cup dried cranberries

You will need:

Large pot with lid and access to a stove, OR electric skillet, OR air popcorn popper, OR microwave
Large mixing bowl
Mixing spoon

Directions:

1. Place large pot on the stove, or plug in electric skillet. If using microwave, place bag in microwave for approximately 3 minutes or until popping slows and skip to step 6.
2. Add the oil and 3 popcorn kernels and cover the pot or skillet.
3. Turn the burner on to medium high, or the skillet on to high.
4. When you hear the kernels pop, add the rest of the popcorn and the salt, and replace the lid.
5. Swirl the pot or skillet as it pops. When the popping starts to slow, turn off the heat and let the skillet cool, or if using a stove, place the pot on a heating pad until the popping stops.
6. After the popcorn is popped, put it in a large bowl and sprinkle lightly with salt if needed.
7. Mix in the sunflower seeds, pumpkin seeds, and dried cranberries.
8. Serve!



**REMEMBER TO
WASH YOUR HANDS**



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Confetti Bean Salsa Recipe

This tasty salsa recipe offers a nice variety of energy-rich seeds that we eat and can be served with corn chips (corn is a seed) or a selection of fresh vegetables.

Makes 20 sample portions

Servings: 9 as a snack

Ingredients:

1 can (15 ounces) dark red kidney beans

1 can (15 ounces) black beans

1 can (15 ounces) corn

2 cups chunky salsa

You will need:

Medium bowl

Can opener

Mixing spoon

Strainer (optional)

Directions:

1. Drain and rinse the beans and corn.
2. Mix together beans, corn and salsa in a medium bowl.

Tasting Tip:

Slice assorted fresh vegetables, such as red, green, orange, yellow peppers; yellow squash, zucchini, cucumbers, broccoli, cauliflower, celery, radishes and carrots to dip in the salsa.



**REMEMBER TO
WASH YOUR HANDS**



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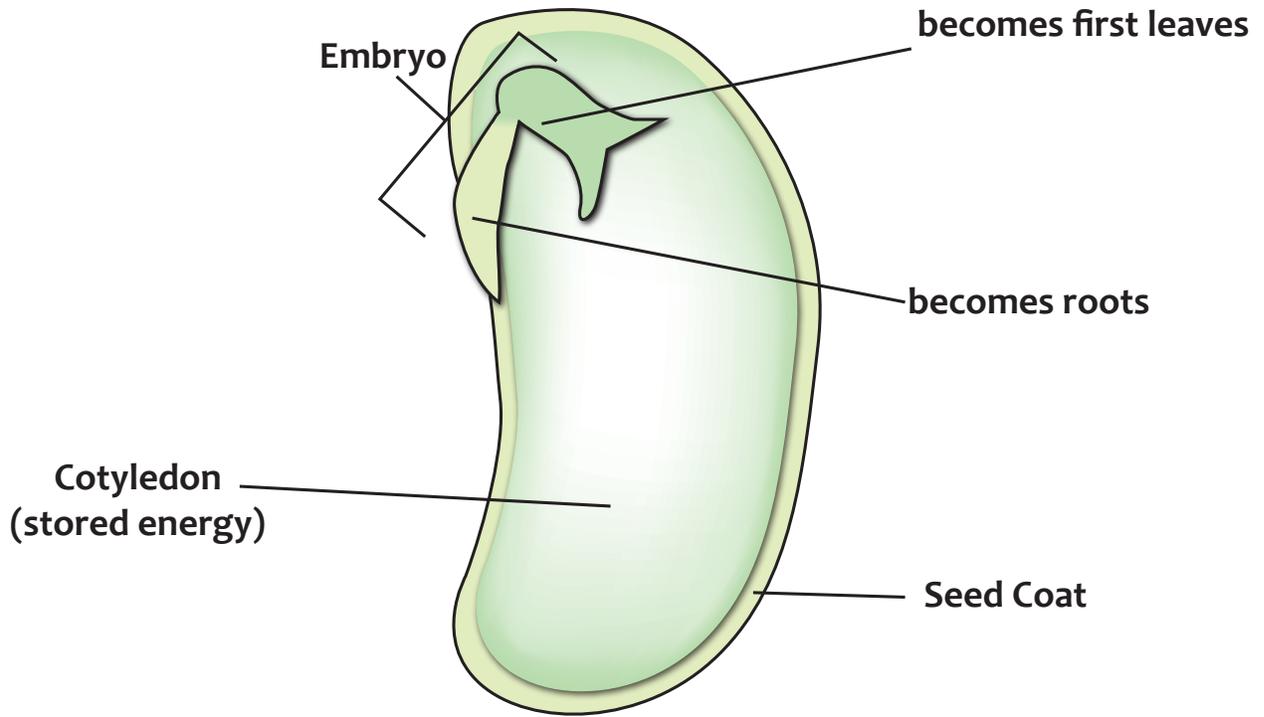


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Seed Anatomy and Germination

Bean Seed Dissection



Seed Germination



Seeds in the Light vs. Seeds in the Dark Experiment

The Scientific Method

Today's Date _____

My Name _____

Hypothesis:

Observations:

Conclusion:



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Keep it Growing

1. Water, Water, Everywhere!
2. To Weed or Not to Weed
3. Put a Lid on it!
4. Garden Journal

Keep it Growing

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Unit Introduction:

This unit teaches the science behind maintaining a garden. It specifically addresses the issues of weeds and water in the garden. Students will learn how water moves through plants and throughout the garden, and how to conserve water. Students will learn what weeds are and why it is important to keep the garden well-weeded. Finally, the students will learn that, just like plants, people need water to be healthy. Students will make a healthy, refreshing drink that's easy to make at home.

Teacher Vocabulary:

1. Water, Water, Everywhere!

Dehydration - the condition in which a living thing does not have enough water in its tissues to maintain optimum functioning.

Evaporation - the process of water turning from a liquid to a gas. This process is accelerated by heat.

Transpiration - the process of water moving through a plant, starting by being absorbed through the roots and then released as water vapor through the leaves.

2. To Weed or Not to Weed (No Vocabulary)

3. Put a Lid on it!

Mulch - any material used to cover a garden's soil to limit water loss and weed growth.

Linking to the Garden: (refer to pages 28 through 30 in the curriculum Introduction)

Schoolyear Programs

Recommended Month: April

Plant:

Transplant: Broccoli, collards, kale

Direct seed: Carrots

Start indoors: Sweet potato slips

Harvest: Leafy greens, lettuce, and spinach to send home with students (late April)

Complimentary gardening activities: Water, weed, and mulch your garden to reinforce the concepts learned in this unit

Growing Season Programs

Recommended Month: June

Plant:

Transplant: Sweet potatoes

Harvest: Beans, broccoli, collards, cucumbers (late June) kale, summer squash (late June) to send home with students

Complementary gardening activities: Water, weed, and mulch your garden

Background:

Many people can be discouraged by the hard work that is needed to maintain a productive vegetable garden. When students understand the science behind maintaining a garden, they will learn that their work is well worth it, and will be rewarded by their harvests.

Conserving water in the garden and ensuring that the plants have an adequate supply of water is one of the major concerns of a gardener. Water makes up the majority of the cytoplasm in plant cells, keeping the cells full and rigid, and the plant upright. Most processes within the plant, the most important being photosynthesis, require an adequate supply of water. Water enters the plant through the root and travels up the stem to tissues throughout the plant. Water is eventually released as water vapor through small holes on the undersides of leaves called stomata. Similar to how people sweat, plants are able to survive extreme temperatures by moving water through their tissues. While it is called perspiration in people, when water moves through and out plants it is called transpiration. The hotter it is outside, the faster plants transpire and the more important it is to make sure they have enough water.

Gardens waste a lot of water in the soil if there are unwanted plants (also known as weeds) soaking up and transpiring water. There are millions of weed seeds in the top six inches of the smallest garden's soil. If weeds are removed, the garden as a whole will be transpiring less water, and therefore, there will be more water available for our vegetable plants.

Another avenue of water loss in the garden is through evaporation directly from the soil. Bare soil will quickly dry out as water evaporates into the air. To prevent, or at least slow this down, gardeners put mulch on their soil and around their plants. Mulch can be anything that covers the soil, from sheets of plastic often used on farms, to wood chips and leaves often used in backyards and in gardens. Straw also works great if it is available. Even sections of newspaper will work, as long as the glossy pages aren't used. Home gardeners should choose a mulch that will decompose and not create waste in the garden.

A second benefit of mulching the garden, aside from water conservation, is that it will prevent weeds from growing. When the soil is covered by mulch, weeds are shaded from light and cannot grow as easily. Mulching is a great way to conserve water in the garden and to keep the water for the plants that need it most: your vegetables!

State Curriculum Identifiers - Keep it Growing - Reading/English Language Arts Standards

Identifier	1st	2nd	3rd	4th	5th	Lesson #s
Standard 2.0 Comprehension of Informational Text						
A.2.	b. Use graphic aids	b. Use graphic aids	b. Use graphic aids such as illustrations and pictures, photographs, drawings, sketches, cartoons, maps (key, scale, legend), graphs, charts/tables, and diagrams	b. Use graphic aids such as illustrations and pictures, photographs, drawings, sketches, cartoons, maps (key, scale, legend), graphs, charts/tables, and diagrams, other graphic aids encountered in informational texts	b. Use graphic aids such as illustrations and pictures, photographs, drawings, sketches, cartoons, maps (key, scale, legend), graphs, charts/tables, and diagrams, other graphic aids encountered in informational texts	1, 3

Standard 4.0 Writing						
A.2.	d. Use details that support a topic with a clear beginning, middle, and end to inform	d. Compose to inform using major points and examples to support a main idea	c. Compose to inform using summary and selection of major points and examples to support a main idea	c. Compose to inform using a structure with a clear beginning, middle, and end and a selection of major points, examples, and facts to support a main idea	c. Compose to inform using relevant support and a variety of appropriate organizational structures and signal words within a paragraph	4

Standard 6.0 Listening						
A.1.	a. Attend to the speaker	a. Attend to the speaker	a. Attend to the speaker	a. Attend to the speaker	a. Attend to the speaker	1, 2, 3
A.1.	b. Respond appropriately to clarify and understand	c. Respond appropriately to clarify and understand	c. Respond appropriately to clarify and understand	c. Contribute relevant comments	c. Contribute relevant comments	1, 2, 3
A.1.				d. Relate prior knowledge	d. Relate prior knowledge	1, 2, 3
A.2.	c. Demonstrate an understanding of what is heard by retelling, asking questions, and relating prior knowledge	c. Demonstrate an understanding of what is heard by retelling, asking questions, relating prior knowledge, and summarizing	c. Demonstrate an understanding of what is heard by retelling, asking questions, relating prior knowledge, and summarizing	c. Demonstrate an understanding of what is heard by retelling, asking questions, relating prior knowledge, and summarizing	c. Elaborate on the information and ideas presented	1, 2, 3
A.2.	d. Follow a set of multi-step directions	d. Follow a set of multi-step directions	d. Follow a set of multi-step directions	d. Follow a set of multi-step directions		2, 3
A.2.					d. Draw conclusions based on the information presented	2, 3
A.2.	e. Listen carefully to expand and enrich vocabulary	e. Listen carefully to expand and enrich vocabulary	e. Listen carefully to expand and enrich vocabulary	e. Listen carefully to expand and enrich vocabulary		1, 2, 3
A.2.	f. Make judgments based on information from the speaker	f. Make judgments based on information from the speaker	f. Make judgments based on information from the speaker	f. Make judgments based on information from the speaker	f. Make judgments based on information from the speaker	1, 2, 3

State Curriculum Identifiers - Keep it Growing - Science Standards

Identifier	1st	2nd	3rd	4th	5th	Lesson #/s
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1.0 Skills and Processes:

C.1.			d. Construct and share reasonable explanations for questions asked	d. Construct and share reasonable explanations for questions asked	d. Construct and share reasonable explanations for questions asked	1, 2, 3
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2.0 Earth/Space Science:

E.1.	b. Describe the changes that occur to water found anywhere.	b. Observe and explain what happens when liquid water disappears. -Turns into water vapor (gas) in the air -Can reappear as a liquid or solid when cooled, such as clouds, fog, rain, snow, etc.	a. Describe how water on Earth changes. -Condensation -Precipitation -Evaporation (only bold items covered)	1, 3
E.1.			d. Describe the processes that maintain a continuous water cycle	1, 3

3.0 Life Science:

E.1.			a. Identify the sun as the primary source of energy for all living organisms. -Plants use sunlight to make food -Plants and animals use food for energy and growth	1
E.1.			c. Identify the things that are essential for plants to grow and survive	1, 2, 3

State Curriculum Identifiers - Keep it Growing - Science Standards continued

Identifier	1st	2nd	3rd	4th	5th	Lesson #s
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3.0 Life Science:

F.1.		b. Explain that organisms live in habitats that provide their basic needs		a. Identify and describe the interactions of organisms present in a habitat. -Competition for space, food, and water -Beneficial interactions: nesting, pollination, seed dispersal, oysters filtering as in the Chesapeake Bay, etc. -Roles within food chains and webs: scavengers, decomposers, producers, consumers (only bold items covered)		2
F.1.						2

State Curriculum Identifiers - Keep it Growing - Health Standards

Identifier	1st	2nd	3rd	4th	5th	Lesson #/s
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Standard 6.0 Nutrition and Fitness

D.1.			b. Describe why the body needs water			1, 3
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Lesson #1: Water, Water, Everywhere!

Time required: 35 minutes (classroom activities: 35 minutes)

Lesson Overview:

1. Students will understand the importance of water in the garden and in their bodies.
2. Students will engage in an activity that studies how water moves through plants.

Students will learn that:

- People should drink plenty of water to stay healthy.
- Like people, plants also need water to stay healthy.
- There are special techniques to keep water in the gardens.

Setup:

- Make copies of “The Water Cycle” handout.

Process:

Introduction (5 minutes)

1. Ask the students to review what plants need to grow and be healthy. They should recall that, among other things, plants need water to survive. Point out that people also need water to survive.
2. Explain that we are going to be learning about water today, and why water is important to both people and plants, especially the plants that are growing in our garden.

Engagement (5 minutes)

Discussion Questions

1. How do we get water into our bodies?
2. What are some of the ways our bodies use water?
3. How does water get into plants?
4. How do plants use water?
5. Are there any similarities between people and plants in relation to water?

Key Points

1. Water is used all throughout our bodies to keep us healthy. Our bodies are $\frac{2}{3}$ water! Water is used to move things around our bodies, during digestion, and to maintain the temperature of our bodies. We lose water through breathing, sweating, and digestion.
2. Besides drinking water, eating fruits and vegetables is an important way that we get water into our bodies.
3. Plants “drink” water by absorbing it through their roots.
4. Plants use water for a number of purposes. One of the most important is photosynthesis. Much like humans, plants also use water to move nutrients around their tissues. They are made up of a large percentage of water (over 80%), just like people.
5. Understanding how water moves through humans and through plants is important to becoming both a healthy human as well as a good gardener.

Activity (25 minutes)

SUMMARY OF ACTIVITIES

1. Students will learn how both the human body and plants use water.
2. The students will engage in the completion of “The Water Cycle” handout, where they will learn how water moves through the air, ground, and plants.

Key Points

1. People and plants need water to complete body functions.
2. Good gardeners should supply an adequate amount of water to their gardens.
3. All people should drink an adequate amount of water.

Activity Process #1 (10 minutes) The Importance of Water to Our Bodies

1. Using the answers from the introduction, explain that water is used throughout our body. In fact, our bodies are 2/3 water! Here are some very important uses of water:

Key Points

1. Every cell, tissue, and organ in our bodies has water in it, and most body functions, like eating, digesting, thinking, seeing, or growing, require water.
2. Starting with our mouth, water helps wash out our digestive system, and helps us digest our food.
3. Water keeps our eyes wet so we can blink and see.
4. Water is the main ingredient in blood, which moves nutrients, vitamins, and oxygen throughout our bodies.
5. Water helps to regulate our body temperature. On a hot day, the body produces sweat to cool down.

2. Explain that water is just as important in plants as in humans. While plants don't have eyes that need to stay wet, or have blood, they are made up of water and need water to live. Plants need water to make food from sunlight, a process called photosynthesis. Without water, plants would not be able to feed themselves!

3. Explain that if people don't drink enough water, they become dehydrated. Being dehydrated means that your body doesn't have enough water to stay healthy.

4. Ask the students to think about the following two questions with a partner for one minute:

Discussion Questions

1. What does a plant look like that doesn't have enough water? How do we know when a plant doesn't have enough water?
2. What would happen to a plant if we never watered our gardens and it didn't rain? Why?

Key Points

1. Explain that when a plant does not have enough water, it will start to droop, get limp, and then dry up. This is because plant cells are made mostly of water, like tiny water balloons. When they aren't given water, the cells become like deflated balloons and the plant becomes floppy.
2. If a plant is without water for long enough, it will die.

Activity Process #2 (15 minutes) “The Water Cycle” handout

1. Pass out a copy of “The Water Cycle” handout to each student. This handout depicts how water travels from the clouds as rain, into the soil, through the plant, and into the air again. Water can also go directly from the ground to the air by evaporating.
2. Work with students to complete the handout, having the students fill in the blanks as you go. Discuss the definitions of each word that goes in the blanks. Although you can start anywhere on the cycle, it is usually easiest to start with the clouds because students should be familiar with them.
3. When talking about transpiration, explain how water travels through a plant. Water enters the plant through the roots, travels up the plant’s stem, and then out of the undersides of the plant’s leaves through tiny openings.
4. After all the blanks are filled in and the water cycle is explained, have one student summarize how water moves through our garden.
5. Explain that as good gardeners, we want to keep as much water as possible in the ground for plants to use.
6. Point out that there are two ways that water leaves the soil: through evaporation and transpiration.
7. ASK:

Looking at the water cycle, what are some ways that we can keep water in the ground?

8. If the students are having a hard time coming up with the answers, use the following questions.

Discussion Questions

1. How can we get more water into the soil for our plants to use?
2. How can we reduce evaporation, which is when water leaves the soil by turning into a gas?
3. How can we reduce transpiration in the garden, which is when water leaves our plants as a gas through the plant leaves?

Key Points

1. Gardeners add water to the soil by watering the garden when the soil is dry. By increasing the amount of water put into the garden, more water will be available to our plants.
2. Good gardeners prevent water from evaporating by covering the soil around their plants with mulch. Explain that mulch is any thing that covers the surface of the soil and keeps the soil underneath moist by preventing evaporation. Mulch can be tree bark, leaves, or straw.
3. There are probably some plants that are growing in our garden that we don't want growing there. They are called weeds. Weeds transpire water just like our vegetable plants, but weeds don't produce food for us, so they are wasting the water in the soil. If we pull weeds out of the garden, then there is less transpiration, and more water for the vegetable plants that we want to grow.

8. Be sure to collect students' handouts as they will be referred to again in Lesson #3 of this unit.

NOTE:

It is best to show these concepts first hand. If you have a garden this would be a good time to water the garden with the students. Using either a hose or watering cans, have the students water the plants in their garden. Remind the students that plants absorb water through their roots, so they should water the soil, not the plants. Explain that the soil below the surface, and not just the surface, should be wet so that the deepest plant roots can absorb water. This takes holding the hose or watering can in one area for several seconds, rather than just a quick spray.

You may also want to remind students that while we want to make sure our plants have enough water, we don't want to waste water by watering unnecessarily. They can decide if the garden needs water or not by sticking their finger in the soil one inch and seeing if the soil is dry. If it is moist, they should wait to water until it is dry. Plant roots will grow deeper and stronger if the soil is allowed to dry between waterings .

Lesson #2: To Weed or Not to Weed

Time required: 25 minutes (classroom activities: 25 minutes)

Lesson Overview:

1. Students will understand plant competition, and why removing weeds from our garden helps grow healthier vegetables.

Students will learn that:

- Similar to humans, plants need an adequate amount of water, nutrients, and energy to survive and be healthy.
- Weeds are plants that grow in our garden that we didn't plant and that we don't want to grow.
- Weeds compete for resources by taking water, nutrients, and sunlight (energy) away from the plants that we want growing in our garden.
- Mulching prevents water from evaporating from our garden.

Gather

- Small paper bathroom cups (approximately 50 total)

Process:

Introduction (5 minutes)

1. Remind students of the concepts about water in our garden that they learned in Lesson #1. Discuss some of the ways that our bodies and our garden plants use water.
2. Review the water cycle. Have students describe how water moves through our garden.

Engagement (5 minutes)

Discussion Questions

1. What is a weed?
2. Why do we weed our garden?

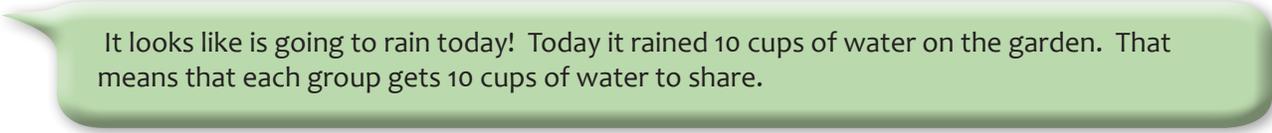
Key Points

1. A weed is anything growing in our garden that we don't want to grow there. Weeds grow because their seeds blow into our garden, and they often grow faster and stronger than our vegetable plants.
2. Weeds take water, nutrients, and sunlight away from the vegetable plants that we do want to grow in our garden.
3. Gardeners remove the weeds from their garden so that their vegetable plants can grow bigger and healthier.

Activity (15 minutes) "Competition in the Garden" Game**SUMMARY OF ACTIVITY**

The class will play a group game that helps demonstrate what happens to our vegetable plants when we have weeds in our garden. They will learn that if we let weeds grow, water is stolen from our vegetables by these unwanted plants.

Activity Process (15 minutes)

1. This game will represent the competition that takes place in the garden. Break the students into groups of 4 or 5. Assign one of the students to be the "carrot plant" of the group, and the other students to be the "weeds".
2. Explain that the class represents the carrot patch in a garden. Some of the people in the class are carrot plants, and some are weed plants.
3. Explain that all plants, whether a carrot plant or a weed plant, need to drink one cup of water every day to survive, but would rather have two cups of water to be healthy and get bigger. You may want to write this on the board because you'll be referring to it later.
4. Pass out 10 cups to each group. Have the students divide them evenly among group members.
5. SAY:


It looks like is going to rain today! Today it rained 10 cups of water on the garden. That means that each group gets 10 cups of water to share.
6. Ask students how the plants managed. Did all get enough water to grow big and healthy?
7. Explain that both the carrot plant and the weeds were able to get their preferred 2 cups of water to grow.

8. Collect cups so that each group only has 5 cups.

9. SAY:

We are now going to pretend that some time has passed, and that it looks like its going to rain again. This time it rains only 5 cups of water.

10. Remind students of the plants' water requirements and ask how the plants in the garden are doing. Does everyone get enough to drink?

11. Explain that although this rain provided enough to drink in order to survive, the carrot plant was not able to get enough to be healthy and grow bigger.

12. Collect cups so that each group only has 2 cups. Tell students that they must share the water in these cups with all of the plants.

13. SAY:

The following week, it only rained 2 cups of water total. Did it rain enough to keep the carrot plant healthy?

14. Review with students that because it is sharing the 2 cups of water with the weed plants, our carrot plant was not able to get enough water to drink.

15. SAY:

Now pretend that a good gardener visited the garden and removed the weed plants. If you are a weed and have a cup, give it to the carrot plant.

16. Ask students if carrots now have enough water to grow and be healthy.

17. SAY:

Weeds compete with our vegetable plants for resources such as water, sunlight, and nutrients. As good gardeners, we can help our vegetable plants get the resources they need to grow by weeding our garden.

NOTE:

It is best to show these concepts first hand. If you have a garden, this would be a good time to weed the garden with the students. Show them which plants are weeds and which are vegetable plants. Demonstrate how to weed, which is done by pulling up the entire weed plant, including the roots. If we only pull up the leafy part, it may grow back.

Lesson #3: Put a Lid on it!

Time required: 40 minutes (classroom activities: 40 minutes)

Lesson Overview:

1. Students will understand that mulching prevents water evaporation and prevents weeds from growing.
2. Students will experience in a new way to incorporate water into their diets by creating a tasty and healthy drink.

Students will learn that:

- Like people, plants need water to stay healthy.
- Mulching and weeding are two ways that gardeners can conserve water in their gardens.

Gather

- The completed “Water Cycle” handout from Lesson #1
- 5 small pots or quart-sized yogurt cups
- Potting soil to fill the pots or yogurt cups
- 5 pieces of paper, shredded or cut into very small pieces
- 5 sandwich baggies
- 2 different color pipe cleaners (20 of one color, 2 of the other)
- Ingredients for “Fizzy and Fruity Water” recipe
- Equipment for “Fizzy and Fruity Water” recipe

Setup:

- Cut pipe cleaners into three sections. You should have 60 pieces of the first color and 6 pieces of the second color after cutting.
- Cut paper and divide among five different plastic bags.
- Fill pots with soil.
- Make copies of “Fizzy and Fruity Water” recipe.
- “Crunchy Vegetable Wrap” optional recipe.

Process:

Introduction (5 minutes)

1. Using the “Water Cycle” handout from Lesson #1, review how water moves through our garden.

Engagement (5 minutes)

Questions

1. If we were to try to prevent water from leaving our garden, what are some steps in the water cycle that we could target?
2. How can we reduce the amount of transpiration in the garden?
3. How can we reduce evaporation in the garden soil?

Key Points

1. Water leaves our garden through two ways: transpiration from plant leaves, and evaporation from the soil. These are places that we could target in order to prevent water loss from our garden.
2. When we take out unwanted plants, or weeds, we can reduce the amount of water that is lost through transpiration.
3. We can reduce evaporation by covering the garden soil. We are going to learn how gardeners can do that today!

Activity (30 minutes)

SUMMARY OF ACTIVITIES

1. Students will create a garden model that they can practice weeding and mulching, and therefore reduce the amount of water lost through evaporation and transpiration.
2. Students will prepare a fun recipe for a tasty and healthy drink.

Activity Process #1 (20 minutes) Weeding and Mulching

1. Divide the class into five groups, and give each group the following materials:
 - 1 pot filled with soil
 - 1 three-inch pipe cleaner of one color
 - 10 three-inch pipe cleaners of a different color
 - 1 plastic baggie filled with shredded paper
2. Explain to them that the first pipe cleaner represents the vegetable plants that we want to grow. Ask the students to pretend that they planted this vegetable two weeks ago, the seed germinated, and it is now starting to grow. Have each group place the pipe cleaner into the soil so that it is sticking out of the soil.

3. Next, explain that other seeds blew into our garden and germinated. These are plants that we don't want growing next to our plant. These are the weeds. Instruct the groups to put their ten pipe cleaners, of a different color, in the soil as well. They represent the weeds that are growing in the garden.
4. Using the concepts covered in the beginning of class, review with students that transpiration and evaporation are the two ways water is lost from the garden.
5. Ask the class to define transpiration. How can the amount of water that is lost to transpiration be reduced?
6. Review that transpiration can be reduced by taking out unwanted plants, which is known as weeding.
7. Instruct the students to weed their garden by taking out the unwanted plants, the ten pipe cleaners.
8. Next, explain to the class that a lot of water gets wasted in a garden because of evaporation. How can we keep water in our soil?
9. Review the definition of mulching. Explain that water evaporates when it touches the air, like water sitting in an open jar. Over time, the amount of water in a jar will decrease because the water is evaporating into the air. However, if the jar has a lid, evaporation stops because there isn't any way for that water to escape.
10. Explain that gardeners can "put a lid on" their soil by mulching around their plants. Ask the class if anyone knows what mulch is.
11. Explain that mulch is anything that you put on your garden soil to prevent water from evaporating and to prevent weeds from growing. Mulch can be a number of things, but most gardeners use straw or leaves as mulch.
12. Ask them to pretend that the paper pieces are leaves, a type of mulch. Instruct the students to take the pieces of paper out of the plastic bag and to "mulch" their garden around the pipe cleaner vegetable plant. Let them know that they should still be able to see their pipe cleaner through the mulch, because that plant still needs sunlight to grow.
13. You may want to have some students leave their "gardens" unmulched. Have everyone water their garden and check daily to observe whether the mulched gardens stay moist longer.
14. Now that their gardens are mulched and weeded, have students review the concepts learned.

Discussion Questions

1. What are the two ways that water will leave your garden?
2. What is one way to prevent water from leaving through plants, or transpiration?
3. What is one way to prevent water from leaving through the soil, or evaporation?

Key Points

1. Water can leave the garden through transpiration and evaporation.
2. Transpiration can be reduced by weeding the garden, which means pulling out unwanted plants.
3. Evaporation can be prevented by mulching the garden.

Activity Process #2 (10 minutes) “Fizzy and Fruity Water” Recipe

1. Discuss with students how often they drink soda or fruit-flavored drinks (such as Kool-Aid™ or Sunny Delight™). Ask them if these are healthy drink choices.
2. Explain that we only give our gardens water because that is the healthiest drink for our plants. Likewise, water is the healthiest drink for us. When we have a lot of sugary drinks like soda and fruit-flavored drinks, we aren’t drinking the healthiest drink for our body.
3. Ask the students for some ideas on how to drink more water when they are thirsty. Discuss when and why they consume drinks other than water.
4. Explain that today we are going to make a healthy drink that is almost all water, but has the flavor and sweetness of soda. It’s easy to make at home, and very refreshing after being out in the garden.
5. Pass out the cups with ice in them. Prepare the “Fizzy and Fruity Water” according to the recipe.
6. **NOTE:** Remember to review with students the importance of clean hands when preparing food. Have all students wash their hands before they begin to handle the food. The curriculum introduction has a useful description of proper hand-washing techniques.
7. Have the students taste their drink, and comment on whether or not they like it. Ask them if they think that this is a better choice than soda. Explain that plants in our garden drink water because it is what they need to be healthy and strong. Like plants, we need to drink water to stay healthy.
8. Encourage students to take the “Fizzy and Fruity Water” recipe home to share with their family.

Journal

Time Required: 20 minutes (classroom activities: 20 minutes)

Lesson Overview:

1. Students will write a creative written response to a prompt related to the content covered in the “Keep it Growing” Unit.

Process:

1. Read the prompt aloud to your students. After answering any questions, allow them time to write a response in their Garden Journals.

Prompt:

Even though weeding and mulching can be hard work, we now understand why it is so important to keeping our garden productive and healthy. Using complete sentences, write a paragraph that describes how water moves through our garden using the following words: transpiration, mulch, water, root, leaf, evaporation, garden, soil, and vegetable.



Garden Journal

Name: _____

Even though weeding and mulching can be hard work, we now understand why they are important for keeping our garden productive and healthy. Using complete sentences, **write a paragraph that describes how water moves through our garden using the following words:** transpiration, mulch, water, root, leaf, evaporation, garden, soil, and vegetable.

Handwriting lines for the journal entry.



Student Vocabulary

Evaporation - the process of liquid water turning into a gas.

Mulch - any material that you put on your garden soil to limit water evaporation and weed growth.

Precipitation - when water falls from the sky in the form of rain or snow.

Transpiration - the process of water moving through a plant (starting by going into the roots and ending by going out the leaves).

Vapor - water that is in the air in the form of a gas.

Weed - an unwanted plant that usually competes for nutrients, water, and space with the plants we are trying to grow.



Fizzy and Fruity Water

When you're thirsty from playing outside or working in the garden, try this easy and healthy drink for some serious refreshment!

Serves 1 drink

Ingredients:

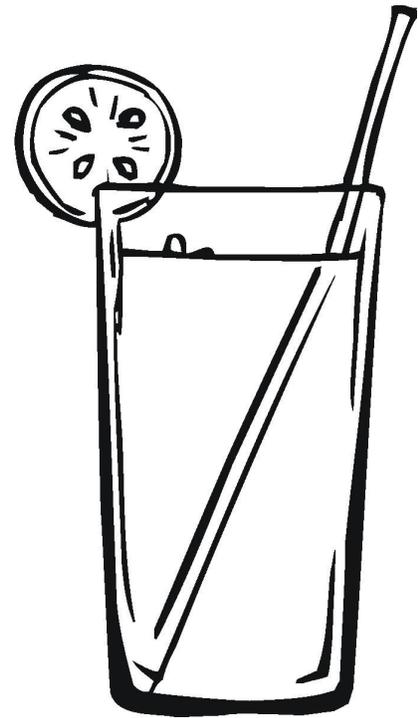
- 3/4 cup sparkling water
- 1/4 cup of orange juice or 100% fruit juice
- 2 ice cubes

You will need:

- Serving cup
- Small mixing spoon

Directions:

1. Put two ice cubes into one serving cup.
2. Put 1/4 cup of juice into the serving cup.
3. Add 3/4 cup sparkling water.
4. Stir and enjoy.



**REMEMBER TO
WASH YOUR HANDS**



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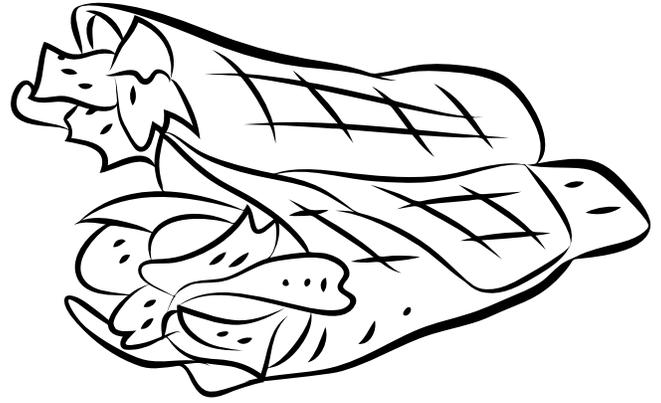
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Crunchy Vegetable Wrap

Like plants, people need water to survive. To stay healthy, we should consume about 8 cups of water each day. This sounds like a lot of water to drink, but the good news is that we can get around 20% of our water from eating plants, such as fruits and vegetables. The vegetables in this recipe are high in water content and are not only healthy to eat, but also a great source of water.



Servings 4

Ingredients:

- 4 Tablespoons low-fat cream cheese
- ½ teaspoon ranch seasoning mix
- 2 flour tortillas
- ½ head of broccoli, washed and chopped
- 1 carrot, washed, peeled and grated
- 1 zucchini, washed and cut into small strips
- 1 summer squash, washed and cut into small strips
- ½ tomato, washed and diced
- 1/4 green bell pepper, washed seeded and diced
- 2 large radishes, washed and sliced thinly

Directions:

1. In a small bowl, stir ranch seasoning into cream cheese, chill.
2. Spread cream cheese onto flour tortilla, staying one inch from edge.
3. Sprinkle vegetables over cheese. Roll tortilla tightly. With a sharp knife slice tortillas into circles and serve.



**REMEMBER TO
WASH YOUR HANDS**



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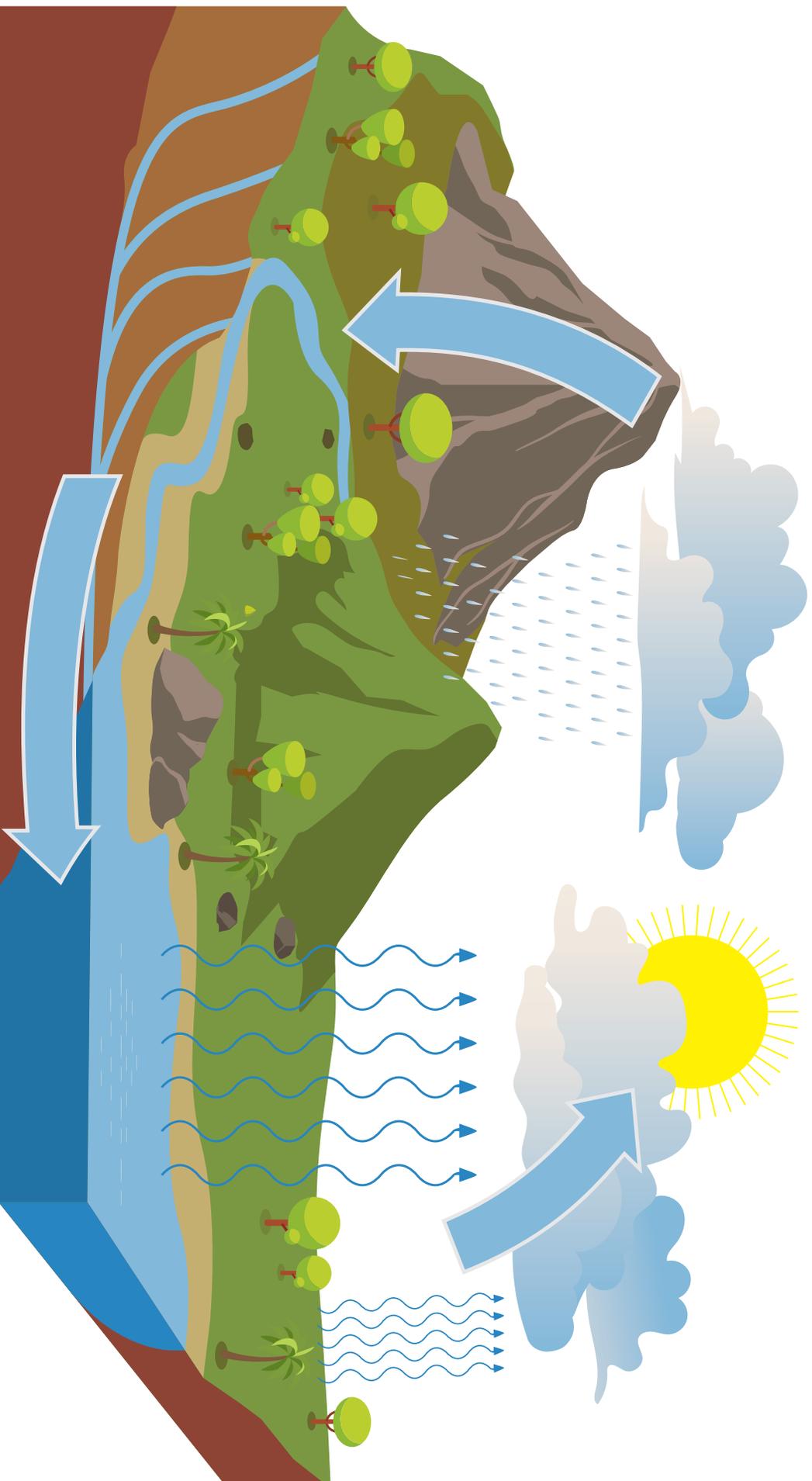
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The Water Cycle

Word Bank:

Absorption Clouds Condensation Evaporation Precipitation Transpiration



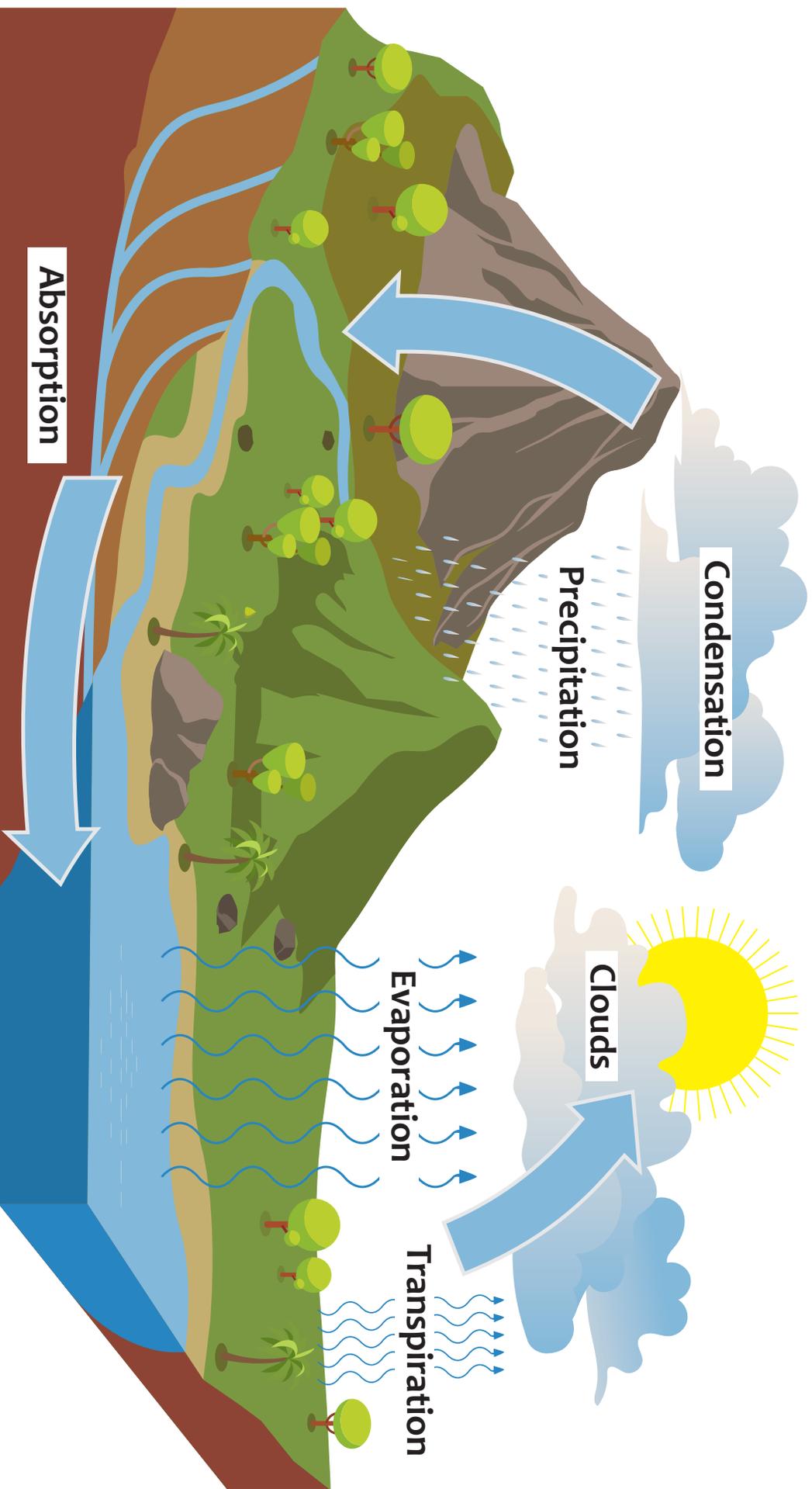
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The Water Cycle

Word Bank:



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Healthy Harvest

1. Garden Inputs and Outputs
2. What is it Worth?
3. Does Money Grow on Plants?
4. Garden Journal

Healthy Harvest

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Unit Introduction:

Although people are aware that fruits and vegetables are great for the health, the high cost of fruit and vegetables makes it difficult for many families to purchase them at the grocery store. Growing fruits and vegetables at home requires some initial start up investment, as well as time and labor. In this unit, students will participate in several classroom activities that will help them understand the monetary value of growing their own fruits and vegetables in a garden. They will complete a handout comparing the value of garden vegetables to the cost of produce in the grocery store. Students will prepare a recipe using produce from their garden and calculate the amount of money they saved by using their own home-grown vegetables.

Teacher Vocabulary:

1. Garden Inputs and Outputs

Community Garden - a piece of publicly or privately owned land where community members can use space to grow food, flowers, herbs, and other plants, either in individual plots, or in collectively-tended gardens.

Input - something put into a system to achieve a result or output.

Output - the yield or product produced by a system.

Resource - anything that has value to humans because it can be used to produce or obtain something else, or because it improves the quality of life.

2. What's it Worth?

Unit - a specified quantity in which an item is typically measured.

3. Does Money Grow on Plants? (No Vocabulary)

Linking to the Garden:

Schoolyear Programs

Recommended Month: May

Plant:

Transplant: Cucumbers, eggplant, peppers, squash sweet potatoes, and tomatoes (if garden will be maintained through the summer)

Harvest: (mid to late May): Baby carrots, spring garlic, leafy greens, peas, and radishes for "Garden Stirfry" (Note: carrots and garlic will still need some time to mature; harvest the biggest for the recipe and leave the rest to grow until the end of the school year)

Complimentary gardening activities: Plan for summer garden care; begin harvesting garden regularly; general garden maintenance

Growing Season Programs

Recommended Month: August

Plant:

Direct seed: Lettuce, radishes

Harvest: Eggplant, garlic, peppers (sweet and hot), summer squash, and tomatoes for "Harvest Fajitas"

Complementary gardening activities: Harvest and weigh all produce; general garden maintenance

Background:

American families, particularly low-income families, often don't include enough fresh fruits and vegetables in their diets. This is partially due to the high cost of fresh produce at the grocery store, compared to many less nutritious foods. Many processed foods are perceived as being a good value for their cost because they are ready to eat and filling, making them appealing to a working family on a budget. However, fresh fruits and vegetables provide essential nutrition that can't be obtained from other sources. Growing vegetables in the garden is a cost-effective way for families to obtain fresh, delicious, and nutritious produce right from the source. In recognition of this fact, the Supplemental Nutrition Assistance Program (SNAP, formerly known as the Food Stamp Program) allows participants to purchase vegetable seeds and food-producing plants using SNAP benefits.

Gardening requires a commitment of time and an initial investment of money that can be daunting to new gardeners. However, once the season is in full-bloom, gardeners can harvest their family's supply of fresh vegetables without a trip to the store. Learning techniques for timely harvest, storage, preparation, and proper preservation will allow the gardener to maximize the household budgeting benefits of growing produce at home.

These lessons invite students to consider the resources that must be invested into a vegetable garden, and the value of the potential returns. They will learn how to calculate the financial savings that a garden can provide while having fun harvesting and cooking the vegetables that they grew!

State Curriculum Identifiers - Healthy Harvest - Reading/English Language Arts Standards

Identifier	1st	2nd	3rd	4th	5th	Lesson #s
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Standard 6.0 Listening

A.1.	a. Attend to the speaker	a. Attend to the speaker	a. Attend to the speaker	a. Attend to the speaker	a. Attend to the speaker	1, 2, 3
A.1.	b. Respond appropriately to clarify and understand	c. Respond appropriately to clarify and understand	c. Respond appropriately to clarify and understand	c. Contribute relevant comments	c. Contribute relevant comments	1, 2, 3
A.1.				d. Relate prior knowledge	d. Relate prior knowledge	1, 2, 3
A.2.	c. Demonstrate an understanding of what is heard by retelling, asking questions, and relating prior knowledge	c. Demonstrate an understanding of what is heard by retelling, asking questions, relating prior knowledge, and summarizing	c. Demonstrate an understanding of what is heard by retelling, asking questions, relating prior knowledge, and summarizing	c. Demonstrate an understanding of what is heard by retelling, asking questions, relating prior knowledge, and summarizing	c. Elaborate on the information and ideas presented	1, 2, 3
A.2.	d. Follow a set of multi-step directions	d. Follow a set of multi-step directions	d. Follow a set of multi-step directions	d. Follow a set of multi-step directions	d. Draw conclusions based on the information presented	1, 2, 3
A.2.	e. Listen carefully to expand and enrich vocabulary	e. Listen carefully to expand and enrich vocabulary	e. Listen carefully to expand and enrich vocabulary	e. Listen carefully to expand and enrich vocabulary		1, 2, 3
A.2.	f. Make judgments based on information from the speaker	f. Make judgments based on information from the speaker	f. Make judgments based on information from the speaker	f. Make judgments based on information from the speaker		1, 2, 3

State Curriculum Identifiers - Healthy Harvest - Math Standards

Identifier	1st	2nd	3rd	4th	5th	Lesson #s
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Standard 3.0 Measurement

B.1.	a. Measure length of objects and pictures of objects to the nearest inch using a ruler	a. Measure length of objects and pictures of objects using a ruler or tape measure to the nearest inch, centimeter, and foot	a. Measure length of objects and pictures of objects using a ruler, a tape measure, a yardstick, or a meter stick			3
B.1.		c. Measure objects to the nearest pound and kilogram	c. Measure weight of objects to the nearest ounce and pound and the mass of an object to the nearest gram and kilogram			3

Standard 4.0 Knowledge of Statistics

A.1.		b. Collect data in tables	b. Organize and display data to make tables using a variety of categories and sets of data			1, 2, 3
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Standard 6.0 Knowledge of Number Relationships and Computation/Arithmetic

C.1.		b. Add no more than 3 whole number addends with no more than 2 digits in each addend and a sum of no more than 100	a. Add numbers using a variety of strategies	a. Add whole numbers	a. Multiply whole numbers	1, 3
C.1.				c. Multiply whole numbers	g. Multiply decimals (depends on price of foods)	1, 3

State Curriculum Identifiers - Healthy Harvest - Social Studies Standards

Identifier	1st	2nd	3rd	4th	5th	Lesson #/s
Standard 4.0 Economics						
A.1.		a. Identify and explain economic choices people make				1
A.2.	a. Give examples of natural and human resources used in production, such as making butter, making ice cream, and building houses	a. Identify the natural, capital, and human resources used in the production of a good or service				1

Lesson #1: Garden Inputs and Outputs

Time required: 40 minutes (classroom activities: 40 minutes)

Lesson Overview:

1. Students will discuss vegetable gardens as production systems that have inputs and outputs. They will discover that a garden's output of healthy vegetables has monetary value.

Students will learn that:

- Growing fruits and vegetables is a low-cost way to obtain healthy foods.
- Gardening requires the input of money when it is created and at the beginning of each season, but the value of the produce grown can far exceed the initial cost of the garden.

Gather

- Calculators (optional)
- 1 broccoli seed packet
- 5 small disposable cups

Setup:

- Make copies of the following handouts for each student:
 - “Garden Store Specials”
 - “Grocery Store Specials”
 - “Value of Garden Inputs and Outputs”
- Copy the table from the “Value of Garden Inputs and Outputs” handout onto the board.

Process:

Introduction (5 minutes)

1. Help the class brainstorm some of the benefits of growing food at home, at school, or in a community garden.
2. Explain that gardening provides healthy food, fun, a good way to learn about nature, a great source of exercise, etc.
3. Explain that one very good reason many people grow food at home is that it helps save money.
4. Explain that the garden is a system for producing food. That means that in order to get something valuable out of gardening, you have to put something valuable into it.

Engagement (10 minutes)**Discussion Questions**

1. Why does food at the store cost money?
2. What resources do we need in order to grow vegetables? What are the inputs we need to put into the garden in order to get vegetables out of the garden?
3. If gardening requires so many inputs, why do we do it? What do we get out of it? What are the outputs from our garden?

Key Points

1. Producing food requires the input of time, labor, and resources. These all cost the farmers who grow our food money.
2. Gardening requires material inputs such as water, soil amendments/fertilizers, seeds, tools, and containers, as well as non-material inputs such as labor, time, and planning.
3. Gardening can produce the following outputs: fresh fruits and vegetables, learning experiences, opportunities for physical activity, fellowship, job skills, and fun.

Activity (25 minutes) Garden Inputs and Outputs**SUMMARY OF ACTIVITY**

Students will use mock garden store circulars to calculate the cost of purchasing materials to start a garden. They will then count the number of seeds in a packet of broccoli seeds to envision how much broccoli they could potentially grow with these resources. They will then calculate the value of that broccoli using a mock grocery store circular.

Activity Process (25 minutes)

1. Review the definition of resource (see unit introduction). Explain that the inputs and outputs from the garden are all resources that have value. Some of them have monetary value, while others are valuable as an experience.
2. Pass out the “Value of Garden Inputs and Outputs” handout. Ask the students to list the garden inputs that were mentioned earlier that must be purchased with money.
3. Record answers in the “Value of Garden Inputs and Outputs” table on the board in the “Garden Inputs” column. Have students do the same on their handouts. Explain that seeds, soil amendments/fertilizer, tools, containers (if relevant) are all garden inputs that cost money.

4. Pass out the “Garden Store Specials” handout.
5. Explain to the students that they will use the ads from the garden store to figure out how much it will cost to buy supplies for a garden.
6. Have the students find the cost of each item in the “Garden Inputs” column and record the cost on the table in the “Dollar Value” column. Record the answers on the table on the board as well. NOTE: Not all items on the “Garden Store Specials” handout will be listed as garden inputs.
7. Have students calculate the total cost of inputs (by hand or using calculators) and record this below the “Garden Inputs” column.
8. Explain that starting a vegetable garden costs money, but it produces fruits and vegetables that are worth money.

9. SAY:

Let’s figure out whether the cost of the inputs is worth the value of the outputs. Most of the materials we purchase for the garden can be used year after year (such as tools and containers), so we don’t have to pay for them again. However, a seed can only be used once. Each seed can produce one plant, one time. Let’s see how many plants we can grow with one packet of seeds.

10. Divide the students into five groups. Divide the contents of the broccoli seed packet into the disposable cups, so that each group gets one cup.
11. Pass the cups out to the groups. Have the students work together to count the seeds in their cup.
12. After each group has finished, have them report how many seeds were in the cup. Add the total number of seeds in the packet (by hand or using a calculator). Record this number in the table on the board in the appropriate blank.
13. Pass out the “Grocery Store Specials” handout. Explain that they will use the ads from the grocery store to figure out the value of all the broccoli we could grow from one seed packet.
14. Have students locate the price of broccoli crowns. Record this number on the board in the appropriate blank.
15. Have the students multiply the number of broccoli seeds by the price of broccoli crowns, and record this number on the chart as well.
16. Ask students to identify which has a higher monetary value, garden inputs or garden outputs.

17. SAY:

Gardening is one way to get healthy foods very cheaply. If we are willing to spend some money in the beginning of the season, and work hard to help our plants grow, we can grow fruits and vegetables and save money at the grocery store.

18. Explain that not every seed will grow, but there are so many seeds in a packet that even if we used only a fraction of them to grow a vegetable, it could help save money. We can also share excess seeds with other gardeners or store them over the winter in our refrigerator or freezer.

19. Point out that a garden will save the most money if the gardener is careful to only purchase items necessary for growing food. Some items sold at garden stores, such as fancy labels and garden accessories may look nice, but they can be expensive, and they don't help your plants grow.

20. Make sure the handouts are collected and saved so they can be used during Lesson #2 of this unit.

Lesson #2: What's it Worth?

Time required: 30 minutes (classroom activities: 30 minutes)

Lesson Overview:

1. Having learned that our garden produces food that is worth money, students will set up a handout that will allow them to calculate the dollar value of the vegetables that they will harvest from the garden for a recipe.

Students will learn that:

- Growing fruits and vegetables is a low-cost way to obtain healthy foods.
- We can track the value of our garden outputs by calculating how much our harvested food would have cost if purchased from the store.

Gather

- Copies of “Grocery Store Specials” handout (from Lesson #1)

Setup:

- Make copies of the following handouts for each student:
 - “Produce Price Calculator”
 - “Garden Stir-fry” recipe (for Schoolyear Programs) or “Harvest Fajita” recipe (for Growing Season Programs)

Process:

Introduction (5 minutes)

1. Review the conclusions from Lesson #1: gardening costs some money, but it produces food that can be worth more money than we spend on the garden.
2. Explain that today we will be preparing for Lesson #3, when we will be cooking a dish using vegetables from our garden. We will set up a handout that will be useful in figuring out how much money the ingredients from the garden are worth.

Engagement (5 minutes)

Discussion Questions

1. What is a name for a tool you use to keep track of money you spend and money you earn?

Key Points

1. A budget is a tool for keeping track of expenses and income. Keeping a food budget is a good way for a family to make sure they are spending money wisely on healthy foods. Keeping a garden budget can help us make sure that our garden is “paying for itself” in the form of food.

Activity (20 minutes) “Produce Price Calculator” handout

SUMMARY OF ACTIVITY

Students will review the recipe of your choice that will be prepared in Lesson #3 using vegetables from the garden, and utilize a handout that will allow them to calculate the value of the garden produce in the recipe based on what it would have cost at the store.

Activity Process (20 minutes)

1. Pass out the recipe handout.
2. Explain to the class that this is the recipe for a dish we will make in the next lesson (Lesson #3). Ask them to circle the ingredients that are growing in the garden.
3. Tell students that since we now know what ingredients we can get from our garden, they will set up a handout that will help figure out how much that produce is worth.
4. Pass out the “Produce Price Calculator” handout.
5. In the “Produce Item” column, list the ingredients that the students circled on the recipe.
6. Redistribute the “Grocery Store Specials” handout from Lesson #1.
7. Have students find the ingredients they listed in the “Produce Item” column on the “Grocery Store Specials” handout. For each item, have them record:
 - a. The unit that item is sold in (in the “Unit” column). Review and explain the concept of units as needed.
 - b. The price per unit of that item (in the “Cost per Unit” column).
8. Ask students to identify the last piece of information needed in order to calculate the value of the produce they will harvest for the recipe.
9. Explain that they will need to know the number of units that are harvested for the recipe.

10. Explain that we will harvest our ingredients right before we cook the dish so they will be very fresh. Students will count and weigh the produce before they cook it and record this information on the handout. After eating, they will calculate the total value of the vegetables harvested from the garden for the recipe!
11. Make sure the handouts are collected and saved so they can be used during Lesson #3 of this unit.

Lesson #3: Does Money Grow on Plants?

Time required: 50 minutes (classroom activities: 10 minutes; food demo (including time to harvest from garden): 40 minutes)

Lesson Overview:

1. Having learned that a garden produces food that is worth money, students will prepare a healthy recipe using garden produce and calculate how much money they saved by growing the vegetable ingredients rather than purchasing them from the store.

Students will learn that:

- Growing fruits and vegetables is a low-cost way to obtain healthy foods.
- We can track the value of our garden outputs by calculating how much our harvested food would have cost if purchased from the store.

Gather

- The incomplete “Produce Price Calculator” handouts as well as either “Garden Stir-fry” or “Harvest Fajitas” recipe handouts from Lesson #2
- Plastic grocery bags for harvesting
- Scissors or hand pruners
- Food scale
- Calculator
- Ingredients for “Garden Stir-fry” or “Harvest Fajitas” recipe (Visit garden to determine what recipe ingredients are ready for harvesting, and what needs to be purchased.)
- Equipment for “Garden Stir-fry” or “Harvest Fajitas” recipe

Setup:

- Cook brown rice if cooking the “Garden Stir-fry”.
- Pre-prep ingredients in recipe that are not classroom-friendly (onion, garlic).

Process:

Introduction (5 minutes)

1. Review what was accomplished in Lesson #2: the class prepared to cook a recipe using garden vegetables, and set up a handout to help calculate how much those vegetables would cost from the store.
2. Explain that the class will complete the activity by harvesting, weighing, and cooking vegetables so that the monetary value of garden vegetables can be calculated.

Engagement (5 minutes)**Discussion Questions**

1. Will we be able to calculate the total value of our vegetable garden with this activity?

Key Points

1. A good gardener can grow vegetables in Maryland from April through November. This activity is only calculating the value of one meal. To really calculate the value of our garden produce, we would need to weigh and record every vegetable we harvest, all season long!

Activity (40 minutes) “Healthy Harvest” Recipe**SUMMARY OF ACTIVITY**

Students will harvest vegetables for the recipe and record the amount harvested on the “Produce Price Calculator” handout. After preparing the dish, students will calculate the total amount of money they saved by growing their own vegetables, rather than purchasing them at the store.

Activity Process (40 minutes)

1. Pass out the recipe and “Produce Price Calculator” handouts.
2. Review the vegetables that are growing in the garden that will be available for harvest for the recipe.
3. Assign students to different harvesting tasks. Take students out to the garden and harvest vegetables for the recipe.
4. Once back in the classroom, have students complete the “Produce Price Calculator” handout: for each item harvested, have them determine the unit listed on the chart, and then weigh, count, or measure how many units were harvested. Enter this number onto the handout in the column under “Units Harvested”.
5. Wash all produce.
6. NOTE: Remember to review with students the importance of clean hands when preparing food. Have all students wash their hands before they begin to handle the food. The curriculum introduction has a useful description of proper hand-washing techniques.
7. Divide students into groups to chop all vegetables. As they work, you can begin preparing the initial steps in the recipe so that cooking can begin as soon as vegetables are chopped.

8. Prepare “Garden Stir-fry” or “Harvest Fajitas” according to recipe. Serve a sample of the dish to each student.
9. After students have enjoyed a sample of stirfry or fajitas, have them complete the “Produce Price Calculator” handout by calculating the value of each item, and summing the total value of the harvested vegetables. Use calculators if necessary.
10. Encourage students to take the recipe of choice home to share with their family.

Journal

Time required: 20 minutes (classroom activities: 20 minutes)

Lesson Overview:

1. Students will write a creative written response to a prompt related to the content covered in the “Healthy Harveřt” Unit.

Process:

1. Read the prompt aloud to your students. After answering any questions, allow them time to write a response in their Garden Journals.

Prompt:

Over the past several months, you have learned that eating a variety of fruits and vegetables is important for a healthy diet, and that gardening provides fresh, delicious fruits and vegetables. In this unit, you learned that gardening is also a great way to save money.

If gardening is such a great solution, why doesn't everyone do it? Write your ideas below in a paragraph. In a second paragraph, make some suggestions of how you, people in your community, or the government could help more people grow some of their own food.



Student Vocabulary

Budget - a written list that keeps track of money spent and money earned.

Cost - the dollar value that must be paid for something.

Input - something put into a system to achieve a result or output.

Output - the yield or product produced by any system.

Resource - anything that has value to us because it can be used to make or get something else, or because it improves our lives.

Unit - a specified quantity in which an item is typically measured.



Garden Stir-fry Recipe

This healthy stir-fry can be made quickly and easily using vegetables that grow in a spring garden! Growing your own vegetables is a great way to save money on your family's food budget.

Makes 20 sample portions

Serves 4-6 as a main dish

Ingredients:

2 tablespoons vegetable oil, such as canola

1 medium onion, sliced

1-2 cloves of garlic, minced

1 inch piece fresh ginger, peeled and grated OR ½ teaspoon ground ginger

1/8 teaspoon cayenne (optional)

3 tablespoons soy sauce

¼ cup water

4 cups of washed, chopped garden vegetables. Here are some spring vegetables that you might have in your garden: broccoli, carrots, snap peas, snow peas, kale, collard greens, mustard greens, turnips, 2 cups dry brown rice, cooked according to package directions

You will need:

Electric skillet or wok

Measuring spoons and cups

Collander

Spatula

Mixing bowls

Cutting boards

Kid-friendly knives (“lettuce knives” work well)

Directions:

1. Heat oil in a large skillet or wok over medium high heat.
2. Sauté onions until they begin to soften, about 3 minutes.
3. Add garlic and ginger to the onions and continue to cook for another minute or so.
4. Add soy sauce to the mixture.
5. Add the vegetables to the skillet or wok, pour in the water, and cover tightly (hint: if you are using hard vegetables, such as carrots, add these first and let them cook for five minutes or so before adding the rest of your vegetables).
6. Cook for 10-15 minutes, or until vegetables are tender but not mushy.
7. Serve over brown rice..



**REMEMBER TO
WASH YOUR HANDS**



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Harvest Fajitas Recipe

These tasty veggie fajitas can be made quickly and easily using vegetables that all grow in a home garden! Growing your own vegetables is a great way to save money on your family's food budget.

Makes 20 sample portions
Serves 4-6 as a main dish

Ingredients:

- 1 large or 2 small zucchini, washed and cut into 1/2 inch thick slices
- 1 large or 2 small yellow squash, washed and cut into 1/2 inch thick slices
- 1 large bell pepper, any color, washed and cut into 1-2" chunks
- 1 eggplant, washed and cut into 1/2 inch thick slices
- 1 medium onion, cut into 8 wedges
- 2 cloves garlic, coarsely chopped
- 1-2 tablespoons olive oil
- 1 teaspoon fajita seasoning, or mix of dried herbs (oregano, basil, parsley)

For Salsa:

- 2 ripe tomatoes, washed and diced
- 1 jalapeño pepper, washed and diced
- 1/2 green bell pepper, washed and diced
- 1/2 medium onion, diced
- Juice of 1 lime

For assembling fajitas:

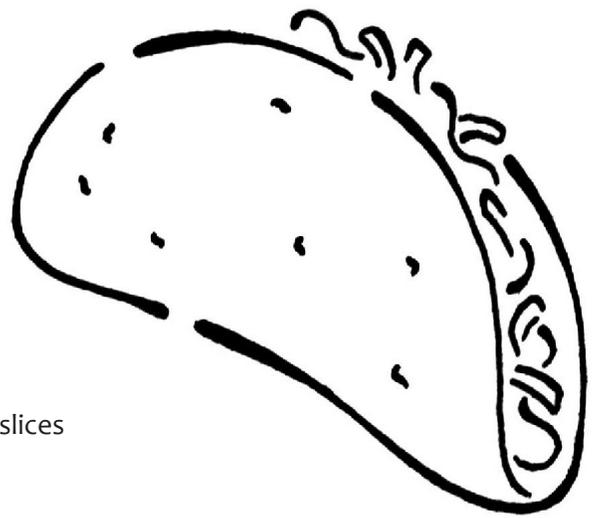
- Whole wheat tortillas
- Low-fat sour cream
- Reduced-fat shredded cheddar cheese

You will need:

- Oven, grill, or George Foreman™ grill
- Spatula
- Collander
- Mixing bowl
- Cutting boards
- Kid-friendly knives ("lettuce knives" work well)
- Serving spoons

Directions:

1. Prepare grill. If unable to grill outside, preheat oven to 400 degrees F.
2. Toss all grilling veggies together in a bowl with olive oil and seasoning.
3. Place a sheet of foil over the grill rack and add veggies. If using the oven, spread on a metal baking sheet and place in oven.
4. Cover and grill, or bake, turning occasionally, until veggies become tender and brown on the edges.
5. Toss all salsa ingredients together.
6. Assemble fajitas by filling a tortilla with a portion of veggies, then topping with salsa and other fixings.
7. Serve!



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Garden Store Specials

Vegetable Seeds



Nothing is as fresh as
home grown!
\$1 per packet

Large Pots



\$2 each!

Potting Soil



Only \$3 per bag!
Enough to fill 2
large pots!

Everyone Needs a Garden Gnome!



Garden Gnome
Sale! \$15 each!

Gardener's Trowel



A gardener's
best friend...
Now only \$2 each!

Fancy Plant Labels



\$8 per dozen!

Compost: The Natural Fertilizer



Sold by the bag...
only \$2 each!

Relax... on a Garden Bench



This week only \$150!



Grocery Store Specials

Broccoli



\$2 per crown

Carrots



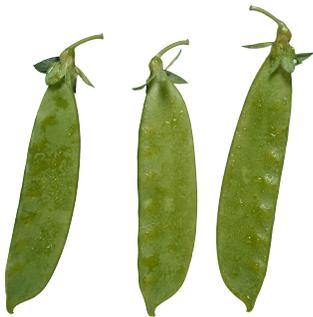
\$2 per 1 pound bag

Tomatoes



\$3 per pound

Snow Peas



\$3 per 1/2 pound bag

Peppers



\$1 each

Jalepeño Peppers



\$0.50 each

Garlic



3 for \$1

All Greens: Kale, Collards, Mustards, and Turnip Greens



\$1 per pound

Eggplant



\$1.50 each

Zucchini and Yellow Squash



\$2 per pound

Snap Pas



\$3 per 1/2 pound bag



Value of Garden Inputs and Outputs Worksheet

Garden Inputs	Dollar Value

Garden Outputs	Potential Dollar Value of Garden Outputs:
	$\frac{\text{ }}{\text{\# broccoli seeds}} \times \frac{\text{ }}{\text{\$ value of broccoli}} = \frac{\text{ }}{\text{\$ value of broccoli}}$



Garden Fitness

1. The Great Green Garden Gym
2. Energy in Food: Quality vs. Quantity
3. Frozen Energy
4. Garden Journal

Garden Fitness

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Unit Introduction:

Most people know that physical activity is important in maintaining a healthy body weight and good health, but they may not have thought about the specific mechanisms that link diet and physical activity together. This unit allows students to observe energy changing forms from stored energy to light and heat energy. This is demonstrated as they burn an almond, illustrating how energy moves from the sun, to our food, and into our bodies, where it is either stored or used to be active.

***NOTE** Before setting up for any lessons in this unit, make sure you are aware of any student nut allergies. Some nut allergies are so severe that it is dangerous for allergic people to be around nuts.

Teacher Vocabulary:

1. The Great Green Garden Gym

Energy - the capacity to do work or change the position or physical state of something.

Fitness - the physical state of being able to comfortably complete activities of daily living and still have energy left over for recreation or responding to emergencies.

Kinetic energy - the energy possessed by an object in motion. Kinetic energy is an example of energy that is being used to do work, and is one example of what is referred to “active” energy in this lesson. Other examples of “active” energy include light energy and heat energy.

Physical activity - any form of exercise or movement. Physical activity requires the conversion of energy stored in our food or in our bodies into “active” energy.

Potential energy - energy that is contained in something that gives it the potential to do work. The energy in food is stored in chemical bonds in molecules, such as sugars and fats. When these bonds are broken, energy is released, which allows our bodies to do work. This is an example of chemical potential energy. Other examples of potential energy include an object raised to a height from which it could fall (gravitation potential energy), or a stretched spring (elastic potential energy). Potential energy is referred to as “stored” energy in this unit.

Transformation (of energy) - the process by which energy is changed from one form to another. Photosynthesis is the process by which plants transform the energy in sunlight into energy stored as sugars in plant tissues.

2. Energy in Food: Quality vs. Quantity

Calorie - a standard unit for measuring energy. The calories a food contains indicates how much energy is stored in it; when we eat food our body “burns” calories by converting the stored energy into active energy used to make our muscles and organs work.

3. Frozen Energy (No Vocabulary)

Linking to the Garden (refer to pages 28 through 30 in curriculum Introduction)

This unit is an extra unit highlighting the importance of physical activity to a healthy lifestyle. It does not fit into any single place in the flow of lessons, but it works best when you are able to get some time in the garden so that students can practice being physically active while gardening.

Background:

Roughly every five years, the USDA’s Center for Nutrition Policy and Promotion releases an updated food guidance system based on current research on nutrition and health outcomes, and current strategies for promoting healthy decision making. These guidance systems, which include the familiar food guide pyramids of the last century, the 2005 MyPyramid, and the 2011 MyPlate, focus on helping Americans make the healthiest choices and consume the proper amounts of foods from each food group. However, beginning with MyPyramid, the USDA’s guidance also included recommendations for achieving an “energy balance”—that is, balancing the calories consumed with appropriate amounts of physical activity to expend the energy in our food.

In 2008, the US Department of Health and Human Services released the first ever Physical Activity Guidelines for Americans (see <http://www.health.gov/paguidelines>). This document summarizes major research findings related to the health benefits of physical activity, as well as recommended types, intensity, and duration of exercise for different segments of the population.

The incorporation of physical activity into health education has become increasingly urgent. As more jobs and leisure activities trend toward the sedentary (e.g., “desk” jobs, T.V. watching, video games), increased awareness is needed to ensure that we are expending the calories that we consume. The Physical Activity Guidelines recommend that children need at least 60 minutes of **vigorous** activity a day and adults benefit from 30-60 minutes. Adults who have lost weight may require as many as 90 minutes of vigorous activity on most days to maintain weightloss. This time can be spent all at once or in increments of at least 10 minutes in length.

While this sounds intimidating to some, there are many benefits to engaging in regular physical activity. Regular physical activity is important for keeping our heart and lungs healthy, building muscle and strong bones, and maintaining flexibility and agility. Furthermore, regular exercise lowers the risk of disease, develops self-esteem, improves mood, and is just plain fun! The best part is that many daily activities, such as brisk walking, cleaning or gardening, if done with gusto, are considered moderate physical activity.

Good nutrition requires us to consider how much we eat, what nutrients we are taking in, and how we are spending our energy. Gardening is one easy way to meet all of these objectives: working in the garden provides an opportunity to be physically active, and the food it produces is both low in calories and high in nutrients!

State Curriculum Identifiers - Garden Fitness - Reading/English Language Arts Standards

Identifier	1st	2nd	3rd	4th	5th	Lesson #s
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Standard 6.0 Listening

A.1.	a. Listen to the speaker	a. Listen to the speaker	a. Listen to the speaker	a. Listen to the speaker	a. Listen to the speaker	1, 2
A.1.	b. Respond appropriately to clarify and understand	c. Respond appropriately to clarify and understand	c. Respond appropriately to clarify and understand	c. Contribute relevant comments	c. Contribute relevant comments	1, 2
A.1.				d. Relate prior knowledge	d. Relate prior knowledge	1, 2
A.2.	c. Demonstrate an understanding of what is heard by retelling, asking questions, and relating prior knowledge	c. Demonstrate an understanding of what is heard by retelling, asking questions, relating prior knowledge, and summarizing	c. Demonstrate an understanding of what is heard by retelling, asking questions, relating prior knowledge, and summarizing	c. Demonstrate an understanding of what is heard by retelling, asking questions, relating prior knowledge, and summarizing	c. Elaborate on the information and ideas presented	1, 2
A.2.	d. Follow a set of multi-step directions	d. Follow a set of multi-step directions	d. Follow a set of multi-step directions	d. Follow a set of multi-step directions	d. Draw conclusions based on the information presented	1
A.2.	e. Listen carefully to expand and enrich vocabulary	e. Listen carefully to expand and enrich vocabulary	e. Listen carefully to expand and enrich vocabulary	e. Listen carefully to expand and enrich vocabulary		1, 2
A.2.	f. Make judgments based on information from the speaker	f. Make judgments based on information from the speaker	f. Make judgments based on information from the speaker	f. Make judgments based on information from the speaker		1, 2

State Curriculum Identifiers - Garden Fitness - Science Standards

Identifier	1st	2nd	3rd	4th	5th	Lesson #/s
1.0 Skills and Processes:						
A.1.	a. Describe what can be learned about things by just observing those things carefully and adding information by sometimes doing something to the things and noting what happens	a. Describe what can be learned about things by just observing those things carefully and adding information by sometimes doing something to the things and noting what happens				1, 2
A.1.	b. Seek information through observation, exploration, and investigation	b. Seek information through observation, exploration, and investigation				1, 2
B.1.	a. Provide reasons for accepting or rejecting ideas examined	a. Provide reasons for accepting or rejecting ideas examined	a. Develop explanations using knowledge possessed and evidence from observations, reliable print resources, and investigations	a. Develop explanations using knowledge possessed and evidence from observations, reliable print resources, and investigations	a. Develop explanations using knowledge possessed and evidence from observations, reliable print resources, and investigations	1, 2
B.1.	b. Develop reasonable explanations for observations made, investigations completed, and information gained by sharing ideas and listening to others' ideas	b. Develop reasonable explanations for observations made, investigations completed, and information gained by sharing ideas and listening to others' ideas				1, 2
B.1.			b. Offer reasons for their findings and consider reasons suggested by others	b. Offer reasons for their findings and consider reasons suggested by others	b. Offer reasons for their findings and consider reasons suggested by others	2
C.1.	a. Describe things as accurately as possible and compare observations with those of others	a. Describe things as accurately as possible and compare observations with those of others	d. Construct and share reasonable explanations for questions asked	d. Construct and share reasonable explanations for questions asked	d. Construct and share reasonable explanations for questions asked	1, 2

State Curriculum Identifiers - Garden Fitness - Science Standards continued

Identifier	1st	2nd	3rd	4th	5th	Lesson #/s
3.0 Life Science:						
E.1.					a. Identify the sun as the primary source of energy for all living organisms, -Plants use sunlight to make food -Plants and animals use food for energy and growth	1, 2

5.0 Physics:						
B.1.		a. Recognize that things that give off light also give off heat				1, 2

State Curriculum Identifiers - Garden Fitness - Health Standards

Identifier	1st	2nd	3rd	4th	5th	Lesson #s
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Standard 6.0 Nutrition and Fitness						
E.1.		a. Discuss the importance of physical fitness and what it means to each individual				1
E.1.			c. Illustrate the importance of balancing food intake with physical activity	a. Define calorie	a. Compare the relationship between caloric intake and output during activity/inactivity	1, 2
F.1.				b. Explain how caloric intake impacts exercise		1, 2
F.1.				c. Describe caloric output during exercise		1, 2

Lesson #1: Almond Energy Burn

Time required: 35 minutes (classroom activities: 10 minutes; outdoor activities (may include gardening): 25 minutes)

Lesson Overview:

1. Students will discuss the concept of energy and its different forms.
2. Students will move outside to observe a demonstration of how energy is transformed from “stored” sources to “active” sources. They will use this information to consider how energy from the sun is transformed by plants, and then again by our bodies.

Students will learn that:

- Energy takes many forms, including “stored” energy (also called potential energy) and “active” energy (such as kinetic energy, light energy, and heat energy).
- Plants store energy from the sun. When we eat plants, our bodies can use this stored energy to be active.
- A healthy lifestyle involves both eating proper amounts of nutritious foods and physical activity.
- Gardening is a good source of both nutritious foods and physical exercise.

Gather

- 1 almond nut
- 1 potato, cut in half
- Paperclip
- Cardboard box (about the size of a shoe box or larger)
- Long “barbeque” lighter
- Stopwatch or watch with a second hand

Setup:

- Cut the bottom out of a cardboard box (this box will serve as a wind shield during the demonstration and will ensure students stay a safe distance from the burning almond).

Process:

Introduction (5 minutes)

1. Display the almond.
2. Ask students what part of the plant the almond is.
3. Explain that the almond is a seed.

4. If you have completed the “Seed Magic” unit, students should recall that almonds and other seeds store energy to help a new plant start growing. When people eat seeds, they give our bodies energy.

Engagement (5 minutes)**Discussion Questions**

1. What does the word “energy” mean to you?
2. What are some words that are related to energy?

Key Points

1. Energy is hard to define because energy can take many forms.
2. Energy is related to many different things such as food, electricity, exercise, wind, gasoline, motion, and heat.
3. Energy can be broken into two categories: energy that is stored, and energy that is being used to do something. We will call these categories “stored” energy and “active” energy.

Activity (25 minutes) Almond Energy Burn Activity**SUMMARY OF ACTIVITY**

Students will be taken outside to make observations while watching an almond burn. This activity is a demonstration of energy changing forms as the almond slowly burns, then eventually burns out as the energy is used up. By observing a burning almond, students will see that energy that is stored in a food plant can be converted to light and heat, just as our bodies convert energy in our food to heat and motion.

Key Points

1. Energy exists in many forms and can be changed from one form to another.
2. Plants get energy from the sun, and animals get energy from eating plants and other animals. Both plants and animals use energy for growth and metabolism, and store any unused energy in their tissues.
3. It is important to keep an energy balance in our bodies. All of the excess energy that we consume in our food must be burned off by being physically active, or we will store the excess energy as fat.

Activity Process (25 minutes)

1. Gather all materials and take students outside to an area with either concrete or bare soil. Set the bottomless box on the ground with half of the potato inside (cut side down) and ask students to gather around it in a circle (some students may have to kneel so that everyone can see inside the box).
2. The potato and paperclip will serve as a stand for the almond while it burns. Use the paperclip to make a cradle for the almond. Straighten the large loop of the paperclip, and bend the small loop in half to set the almond inside.
3. Stick the straight end of the paperclip in the potato, while the almond lies in the cradle.
4. Ask students to make a hypothesis about what will happen when the almond is lit on fire.
5. Light the almond (it might take up to 30 seconds of lighting to stay lit) and have one of the students record how much time it takes to burn using a stopwatch or watch with a second hand.

Discussion Questions

1. What forms of energy are being released by the almond as it burns?
2. Where is the light and the heat coming from?
3. Where did the almond get the light and the heat?
4. What made the fire go out?

Key Points

1. The almond is giving off light and heat energy.
2. The light and heat are produced from the energy that the almond tree stored in the nut while the almond tree was growing.
3. The energy in the almond came from the sun. The almond plant transformed it into stored energy through photosynthesis.
4. The almond stops burning when all of this stored energy has been used up.

6. SAY:

We know that plants get energy from the sun. Through photosynthesis, the plant changes light energy into stored energy. That energy is then used by the plant to grow, or it is stored for later use. Seeds store energy so that new plants can start growing. Some plants also store energy in roots and fruits. Energy that is stored, such as the energy in the almond, can change forms to produce “active” energy, such as the light and heat that was released from the almond as it burned.

7. Discuss the above statements. Highlight the fact that energy stored in plants is available to us when we eat plant foods.

8. SAY:

Just like plants turn light energy into stored energy, our bodies turn stored energy in plants into other forms of energy. What does our body do with the stored energy in plants when we eat foods such as the almond?

9. Explain that our bodies turn stored energy in foods into active energy that is used to do things like make our heart pump and our muscles work. If the energy is not used for body functions or physical activity, it is stored in the form of fat.

10. Explain that it is important to achieve an energy balance in our bodies. This means that all of the calories we take in are transformed into active energy, rather than stored as fat.

11. Emphasize that physical activity is important for many reasons, not just to prevent weight gain. Being physically active is extremely good for our bodies.

12. Ask students what some of the benefits of being physically active are. Be sure to highlight items such as fun, cardiovascular health, self-esteem, coordination, stress relief, mood elevation, strong muscles, strong bones, etc.

13. Explain that gardening is a great activity because it contributes to both sides of the energy equation. The food we grow provides energy as well as vitamins, minerals, phytochemicals, and fiber. Gardening is also a great way to use some of those calories while we are moving, bending, stretching, and having fun.

14. If appropriate, complete gardening activities. You may want to have students take their pulse before beginning activities and after a few minutes of work to convince them that they are actually getting exercise while they work.

Lesson #2: Energy in Food: Quality vs. Quantity

Time required: 35 minutes (classroom activities: 20 minutes; outdoor activities: 15 minutes)

Lesson Overview:

1. Students will complete an experiment demonstrating that different foods contain different amounts of energy.
2. Students will use their observations and conclusions from the activity to discuss some of the factors that should be considered in making food choices.

Students will learn that:

- Different foods contain different amounts of energy.
- Balancing calories consumed with calories expended through body functions and physical activity is important for maintaining good health.
- In deciding whether a food is good for our bodies, we must consider how much and what kinds of nutrients a food provides in addition to how many calories it has.
- When we consume “quality calories”, our bodies get energy, but also vitamins, minerals, and other nutrients we need to grow.

Gather

- 1 almond nut
- 1 mini marshmallow
- 1 potato, cut in half (you may reuse the potato from Lesson #1)
- 2 paper clips
- Long “barbeque” lighter
- Cardboard box with bottom cut out (you may reuse the box from Lesson #1)
- Clipboards (optional)

Setup:

- Make copies of the following handouts for each student:
 - “Almond Versus Marshmallow Burn Experiment.”
 - “Reading Nutrition Facts Labels.”
 - “Almond Versus Marshmallow Nutrition Facts Label.”

Process:

Introduction (5 minutes)

1. Review the conclusions from the demonstration in Lesson #1.
2. Remind students that there is more to good nutrition than energy. Food choices must be judged based on both energy and nutrient content.

Engagement (5 minutes)**Discussion Questions**

1. What forms does energy take as it travels from the sun to plants to our bodies?
2. What does it mean to achieve an “energy balance”?

Key Points

1. Light energy from the sun becomes stored energy in plants. That stored energy is converted into active energy in our bodies when we eat plant foods.
2. When all of the energy that we consume from our food is used by our bodies to function and be active, we are in energy balance. If we consume more energy than our bodies need, we need to increase our physical activity to use the extra calories. Otherwise, our body stores the extra energy in the form of fat.

Activity (25 minutes)**SUMMARY OF ACTIVITIES**

1. Students will go outside and observe stored energy as it is converted to active energy in two different foods: almonds and marshmallows. The marshmallow will burn faster than the almond because it contains less stored energy (i.e., it has fewer calories).
2. The students will review the nutrition facts labels for these foods and consider both the quality and the quantity of the calories they contain when deciding which is a healthier food choice.

Key Points

1. Foods that have more calories will take a longer time for our bodies to burn off.
2. It is important to consider the nutrient content, as well as calories, of foods we eat, and always remember to include foods high in vitamins, minerals, fiber, and other nutrients.

Activity Process #1 (15 minutes) Almond Vs. Marshmallow Energy Burn

1. Pass out “Almond versus Marshmallow Burn Experiment” handouts.
2. Explain that they will complete a second food-burning experiment to learn more about energy and nutrient content of foods, this time burning both an almond and a marshmallow.

3. Remind students that a hypothesis is an educated guess about what will occur with our experiment. Have students record their hypothesis. You may need to guide students in coming up with some possible hypotheses, such as:

The almond will burn faster than the marshmallow.

The almond will burn slower than the marshmallow.

The almond and marshmallow will burn at the same speed.

4. Take students outside to complete the experiment. They can either bring their experiment handout on a clipboard to record observations, or they can leave them in the classroom to complete when they return.

5. Place the bottomless box on the bare ground or concrete to contain the experiment. Place the two potato halves (flat side down) inside the box.

6. The potato and paperclip will serve as a stand for the foods as they burn. Bend two paperclips to form a cradle with a straight stem. Poke the straight stem of each paperclip into a potato so that it stands up.

7. Place one almond in one cradle, and one marshmallow in the other.

8. Light the almond and marshmallow on fire. If you have a stop watch, you can burn one at a time and record the time it takes for each to burn out. If you do not, you can light them both at the same time.

9. Make observations as a class. If students brought their experiment sheets, they may record their observations. Otherwise they can record them when they return to the classroom. NOTE: The marshmallow should burn much faster than the almond.

Activity Process #2 (10 minutes) Almond versus Marshmallow Nutrition Facts Label Discussion

1. Return to the classroom and review what the students observed during the experiment.

Discussion Questions

1. The almond and the marshmallow are roughly the same size. Why did the marshmallow burn faster?
2. What does this tell us about these foods? Is one a better choice than the other?

Key Points

1. The almond contained more stored energy than the marshmallow; therefore, it burned for a longer period of time. Energy is measured in calories. The number of calories in a food tells us how much energy is stored in it. The almond contains more calories, and therefore it took longer for all of that energy to be converted to light and heat.
2. It might seem that the marshmallow is a better food choice because it contains fewer calories for our body to have to burn off. However, when considering the energy content (calories) of a food, you must also consider the quality of the nutrients you're getting along with those calories.

2. Have students write their conclusions on their handouts stating whether their hypothesis was correct and explaining what they observed.
3. Pass out the “Reading Nutrition Facts Labels” handout.
4. Explain to students that nutrition facts labels help us judge whether or not a food is a healthy choice. Foods contain nutrients that our bodies need in order to grow and be healthy, but they can also contain things, such as saturated and trans fats, added sugar, and lots of salt, that can be unhealthy if we eat too much.
5. Explain that the servings size amount is found at the top of the food label and is the most important place to start when getting your nutrition information. Emphasize that all of the information contained in the nutrition facts label pertains to this serving amount. If you eat twice the serving size, you will get twice the amount of calories, nutrients, sugar, etc.
6. Point out the lines on the nutrition facts label that show which items we need to make sure we get enough of: fiber, protein, vitamin A, vitamin C, calcium, and iron. Emphasize that we should be choosing foods throughout the day that contain these items.
7. Point out the lines on the nutrition facts label that show which items that we should try not to eat too much of: cholesterol, sodium, and fat depending on the age of your students, you may want to explain that while we want to be careful to limit our overall fat intake, there are some fats that are less healthy than others. Appropriate amounts of unsaturated fats are part of a healthy diet, but saturated and trans fats are unhealthy and should be limited in the diet.
8. Pass out the “Almond Versus Marshmallow Nutrition Facts Label” handout.
9. Review the label, and have students circle the nutrients they should get enough of and label the circle with “get enough”. Have the students circle the things they should be careful not to get too much of and label the circle with “not too much”.
10. Highlight the differences between the two foods: almonds are higher in calories and fat, but they are also high in protein and provide fiber. Most of the fats in almonds are healthy fats (they are high in unsaturated fat and low in saturated fat and have no trans fats). Marshmallows on the other hand, are lower in calories, but do not provide those important nutrients that we should aim to “get enough” of throughout the day.
11. Ask students which food choice they think is healthier.

Key Points

1. There are two things to think about when you consider the energy content of food, measured in calories.
 - a. Quantity: Balancing calories in with calories out. We want to be sure we don't eat more calories than we use. Being physically active is a great way to ensure that we use all of the energy we consume. Being physically active also helps keep our muscles, bones, hearts, and lungs strong, and it makes us feel good.
 - b. Quality: The foods that we eat should contain quality calories. We can get energy from eating a lot of candy, but candy provides no vitamins, minerals, fiber, or other nutrients, therefore it is not a good dietary choice.
2. Remind students that gardening is a form of physical activity, and we can actually burn lots of calories while working. We are also producing foods that contain high quality calories. Remember that vegetables are low in calories but high in vitamins, minerals, fiber, and phytochemicals. That's a lot of bang for our buck!

Lesson #3: Frozen Energy

Time required: 25 minutes (food demo: 25 minutes)

Lesson Overview:

1. Students will help in the preparation of an energy smoothie which provides them with energy, as well as other important nutrients.

Students will learn that:

- A healthy lifestyle involves both eating proper amounts of nutritious foods and physical activity.
- Healthy foods provide lots of nutrients in addition to energy.

Gather

- Ingredients for “PBJ Energy Smoothie” recipe
- Equipment for “PBJ Energy Smoothie” recipe
- or
- Ingredients for “Dilly Spinach Dip” recipe
- Equipment for “Dilly Spinach Dip” recipe

Setup:

- Copies of “PBJ Energy Smoothie” recipe
- “Dilly Spinach Dip” optional recipe

Process:

Introduction (5 minutes)

1. Review the conclusions from the experiments from Lessons #1 and #2. Highlight the different types of energy, the concept of energy balance in the body, and the important factors that influence nutritious food choices.

Engagement (5 minutes)

Discussion Questions

1. What are two key points we should consider when judging whether a food is “worth” the calories?

Key Points

1. We should consider both the number of calories it contains, as well as how much and what types of nutrients it contains—in other words the quality of the calories. Foods that are low in calories and high in nutrients are the best choices. Foods that are high in calories but low in nutrients should be considered “sometimes foods”.

Activity (30 minutes) “PBJ Energy Smoothie” Recipe

SUMMARY OF ACTIVITY

Students will prepare a smoothie that provides energy for being active and lots of nutrients.

NOTE: Please see allergy note in unit introduction.

Activity Process (30 minutes)

1. Hand out recipes and set up blender.
2. Review the parts of the recipe: Introduction, Ingredients, and Directions. Point out that the ingredients in this recipe provide good sources of energy, calcium, protein, vitamins, phytochemicals, and healthy fats.
3. **NOTE:** Remember to review with students the importance of clean hands when preparing food. Have all students wash their hands before they begin to handle the food. The curriculum introduction has a useful description of proper hand-washing techniques.
4. Have students follow recipe to make smoothies.
5. Encourage students to take the PBJ Energy Smoothie recipe home to share with their family.

Journal

Time Required: 20 minutes (classroom activities: 20 minutes)

Lesson Overview:

1. Students will write a creative written response to a prompt related to the content covered in the “Garden Fitness” Unit.

Process:

1. Read the prompt aloud to your students. After answering any questions, allow them time to write a response. This journal is not printed in the Garden Journal collection so it will need to be copied and given to students as a handout.

Prompt:

Plants are amazing! You just learned that they can take energy from the sun and turn it into energy that they use to grow, and energy our bodies can use when we eat plant foods. You might even think of plants as batteries that store the sun’s energy.

Eating healthy foods from our garden will help us be healthy and full of energy. But its important that we use that energy to be active. In the space below, write a paragraph describing some of your favorite ways to be active. In a second paragraph, write how you feel after doing some of those favorite activities.



PBJ Energy Smoothie

Smoothies are a great way to start your day! They will provide you with lots of energy to get you through the morning, plus protein, calcium, vitamins, and phytochemicals

Makes 20 sample portions
Serves 4 -1 cup servings (for breakfast or a hearty snack)

Ingredients:

- 2 cups frozen strawberries or other frozen berries
- 3/4 cup low-fat vanilla yogurt
- 1/2 cup low-fat milk
- 2 Tablespoon peanut butter (optional)

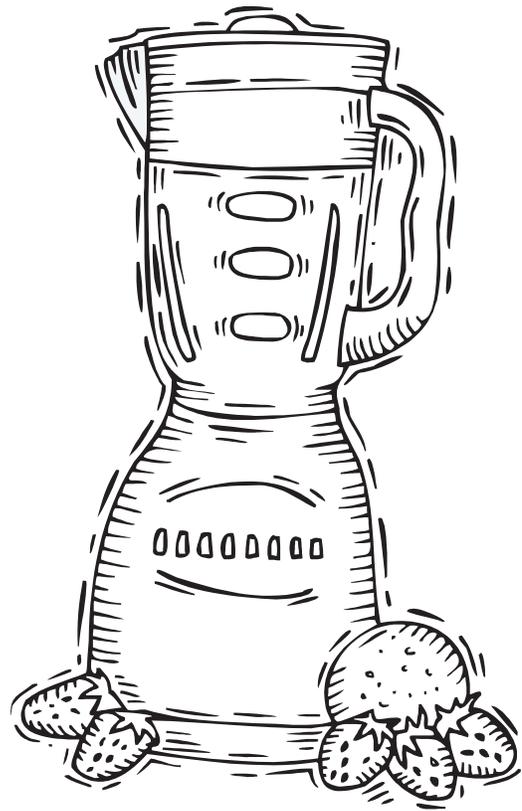
(Sunbutter, soy-nut butter, or almond butter can be used as an alternative)

You will need:

- Blender
- Cups

Directions:

1. In a blender, combine all ingredients.
2. Puree until smooth.
3. Serve immediately.



NOTE: This recipe contains ingredients made with nuts. Please be aware of any nut allergies before serving.



**REMEMBER TO
WASH YOUR HANDS**



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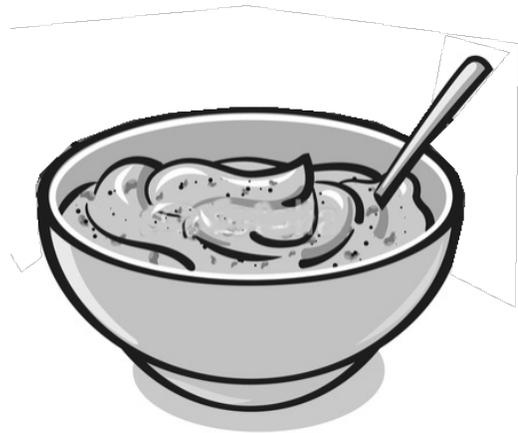


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Dilly Spinach Dip

Spinach is loaded with niacin, zinc, protein, fiber, and important vitamins, such as Vitamins A, C, E, and K. Frozen spinach is picked fresh from the farm and flash-frozen to hold in these nutrients. When it is thawed and prepared in a recipe, like this one, you can enjoy all of the health benefits from this super food!



Servings: 32

Ingredients:

- 1 10-ounce package frozen, chopped, spinach (thawed and squeezed dry)
- 1 cup low-fat or fat-free cottage cheese
- 1 cup low-fat or fat-free sour cream
- 2 teaspoons dried dill
- ½ teaspoon garlic powder
- ½ teaspoon onion powder
- Cut up vegetables for dipping (e.g., carrots, celery, broccoli, summer squash, radishes)



**REMEMBER TO
WASH YOUR HANDS**

Directions:

1. Wash hands thoroughly and squeeze the water from thawed spinach over sink or bowl. Place squeezed spinach into medium-size bowl.
2. Puree cottage cheese and sour cream together in food processor or blender or mash cottage cheese with fork until most of lumps are smooth.
3. Thoroughly mix squeezed spinach and blended mixture in medium size bowl using a fork to break the spinach apart.
4. Add seasonings and mix thoroughly.
5. Cover and refrigerate for 2 hours to blend flavors.
6. Serve as a dip with cut-up vegetable pieces for dipping.



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Nutrition Facts

2 Servings per container

Serving size 1 1/2 cup (208g)

Amount Per Serving

Calories 240

% Daily Value*

Total Fat 4g	5%
Saturated Fat 1.5g	8%
<i>Trans Fat</i> 0g	
Cholesterol 0mg	2%
Sodium 430mg	19%
Total Carbohydrate 46g	17%
Dietary Fiber 7g	25%
Total Sugars 4g	
Includes 2g Added Sugars	4%
Protein 11g	
Vitamin D 2mcg	10%
Calcium 260mg	20%
Iron 6mg	35%
Potassium 240mg	6%

Not Too Much

Get Enough

Not Too Much

Get Enough

* The Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.



Appendix

Gardening Resources

Home and Garden Information Center

Questions about your garden? Trained horticultural experts from the University of Maryland are waiting to answer your plant and pest questions! Visit <https://extension.umd.edu/hgic/get-help> to submit a question on-line.

The Home and Garden Information Center also has numerous free online publications that will be helpful to those starting or maintaining gardens. Go to <http://extension.umd.edu/hgic/resources> for a complete list of their publications. The following will be of special interest to school gardeners.

- Starting a Container Garden: HG600 (.pdf)
- Growing Greens in a Salad Table: HG601 (.pdf)
- Planting Dates for Vegetables in Maryland: HG16 (.pdf) and GE008 (.xls)
- Monthly Tips for Food Gardeners: GE003 (.pdf)
- Twenty Vegetable Crops for School Container Gardens: GE133 (.pdf)

Master Gardener Program

Master Gardeners have received horticultural training and are required to complete volunteer community education hours in order to maintain their certification. Master Gardeners can help you plan a successful garden and find resources. To connect with a Master Gardener in your community, contact the county Master Gardener coordinator. Visit <https://extension.umd.edu/mg/local-programs-and-coordinators>.

Grow it Eat it Program

In 2009, Maryland Master Gardeners initiated a new project specifically aimed at helping Marylanders start growing some of their own food. Your county's Grow it Eat it team may be able to provide a presentation at your site on the basics of vegetable gardening. Visit <https://extension.umd.edu/mg/about-program/grow-it-eat-it> for links to blogs, videos, and podcasts, as well as additional educational information for the garden.

For more information about starting a school garden, visit <http://extension.umd.edu/growit/youth-gardening> for helpful videos, fact sheets and helpful resources.

Kids Gardening

The National Gardening Association has an excellent website and store exclusively dedicated to gardening with kids. Visit <http://www.kidsgardening.org> for resources, ideas, and materials. Join their listserve for regular newsletters containing lesson plans and grant notifications!

Indoor Gardens

The Growing Healthy Habits Curriculum is structured around opportunities for students to engage in outdoor gardening activities. While outdoor gardening provides a deep understanding of agriculture, soil ecology, plant life cycles, and seasonality, some sites may not have outdoor space or water access for growing vegetables (even in containers), or may be limited by the time required to travel outside to garden.

Indoor gardens can provide reinforcement of the concepts taught in Growing Healthy Habits, and provide ingredients for some of the recipes. Indoor gardens can produce plants any time of year, eliminating one of the major restrictions of school year gardening. Teachers who choose to grow indoor gardens can teach the lessons in whatever order complements the timing of the planting and harvesting of their vegetables.

Growing indoors under artificial light sets limitations on what can be grown to a harvestable size. The best crops for indoor gardening include leafy green vegetables and small roots such as lettuces, kale, radishes, chard, beet greens, bok choy, and turnips (harvested as babies). Note that these plants can be sprouted and grown for a few weeks using only the light available on a windowsill; however, they will need artificial light if they are to grow to mature, harvestable size.

A simple, inexpensive light stand for indoor lighting using pvc pipes and a shop light is outlined on the University of Maryland Extension Grow It Eat It website <https://extension.umd.edu/hgic/topics/pvc-light-stand>. This light stand can be built for approximately \$47 and small growing containers can be made using plastic milk jugs, cut in half with holes punched in the bottom. The containers can be placed on a cookie sheet or other tray to collect excess water and placed under the light stand to start seedlings.

Building and Indoor Garden Light Rack

Adapted from the Cultivating Health And Nutrition through Gardening Education curriculum, Washington State University Extension

Materials:

- (1) 1-1/4" lumen PVC pipe, 4' 5" long
- (2) 1-1/4" lumen PVC pipe, 2' long
- (2) 1-1/4" lumen PVC Elbow SLxSL
- (2) 1-1/4" lumen PVC Tee SLxSLxSL
- (4) 1-1/4" lumen PVC ST90 Elbow SLxSL
- (4) S hooks
- (4) Eye bolts 1/4" x 3"
- (2) 2' long pieces of chain
- (2) 1/4" Washers
- (2) 1/4" Nuts
- (1) 4' long florescent shop light with bulbs

Tools:

- Hacksaw (for cutting PVC pipe, if not cut to length at the store)
- Drill with 1/4" or 3/8" drill bit
- Metal snips (for cutting chain, if not cut to length at the store)

Instructions:

1. Drill one hole through the 4' 5" long PVC pipes 6" from one end. Repeat on other end.
2. Slip the eye bolt through each of the drilled holes and secure with a washer and nut.
3. Attach the PVC elbows to both ends of the 4' 5" pipe such that both the eye of the bolts and the open end of the elbows are facing downwards.
4. Attach the 2' PVC pipe legs into each end of the elbow.
5. Insert PVC tee into the bottom of each 2' leg.
6. Attach PVC ST go elbows into both ends of each PVC tee.
7. Hook S hooks onto each eye bolt. Hang chains from the S hooks.
8. Assemble 4' long fluorescent shop lights and hook to chains. Adjust height such that lights stay about 6" above growing plants.

Sample Garden Budget Worksheet

This worksheet should help you generate a list of materials, and their associated cost, for developing a garden to complement this curriculum. Listed prices are rough figures; confirm the actual price with the source before you purchase anything. Use this budget to present to funders or include in grant applications.

Container Garden

Item	Number required	Cost per item	Total cost
Containers with drainage holes (various sizes—1 quart-5gallon)		FREE (get 5-gallon buckets from food stores!) OR up to \$10.00 each	
Potting soil		\$4.00/16 quart bag	
Organic fertilizer		\$6.00/5 lb bag	
Seeds		FREE (request last year's seeds from seed companies) OR \$2.00/packet	
Seedlings		\$3.00 each	
Hand trowels		\$3.00 each	
Gloves		\$2.00/pair	
Watering cans		\$6.00 each	

Grand total:

Sample Garden Budget Worksheet

This worksheet should help you generate a list of materials, and their associated cost, for developing a garden to complement this curriculum. Listed prices are rough figures; confirm the actual price with the source before you purchase anything. Use this budget to present to funders or include in grant applications.

Indoor Garden

Item	Number required	Cost per item	Total cost
PVC pipe and fittings to build light stand		\$20	
Florescent shop light with bulbs		\$20	
Growing containers		FREE (if using milk jugs) or up to \$5 per pot	
Potting soil	2 quarts per each milk jug, or quantity needed for your chosen containers	\$4.00/16 quart bag	
Organic fertilizer		\$6.00/5 lb bag	
Seeds		\$2.00/packet	
Gloves		\$2.00/pair	
Watering cans		\$6.00 each	

Grand total:

Youth Gardening Program Planning Document

Use this document to organize your ideas, inventory your resources and assess your needs in developing your gardening program. Engage other teachers / staff / volunteers at your site in the process.

Building A Youth Garden Team

Do you have commitment or buy in from all necessary stakeholders? Who needs more information to be persuaded? What types of information should you present to them?	
Which of the stakeholders are going to part of your gardening team? Who is going to lead this team?	
Who in this team needs training? What type of training? How is that training going to happen?	
Who is deciding the goals and activities of the garden?	
Who will provide gardening expertise?	
Who will be teaching the educational content of the gardening program?	
Where will you get the labor to build the garden? How many volunteers do you need to recruit?	
How will you establish clear lines of communication around the garden?	



Defining Your Program

Who is your target audience? <ul style="list-style-type: none">• Age range?• Specific demographics? (low income, special needs, etc.)• How many students will be using the garden?	
Describe the site: <ul style="list-style-type: none">• In school• After school• Summer	
During what months will your program run?	
When will gardening occur? When will programming (lessons, etc.) occur? How often?	
What are YOUR goals for the program? What are the goals of the SITE?	
How do your goals and the goals of the site intersect?	



The Garden Design

<p>What type of garden will you have?</p> <ul style="list-style-type: none">• Raised beds,• in ground,• containers	
<p>How big will your garden be? How many beds/pots? What size beds/pots? Is this an appropriate size to meet your goals?</p>	
<p>Where will your garden be located? Does this location have:</p> <ul style="list-style-type: none">• Sunlight• Easy access for students, staff, and volunteers• Water	
<p>What plants have you had success growing in the past? What crops meet your curricular needs?</p>	
<p>Do you have a garden plan? This should include a map of your space(s), planting layouts for the season (where and how much you will plant), a planting schedule, and a maintenance plan. Who will you contact for assistance to create this plan?</p>	
<p>Who will plant the garden?</p>	
<p>Who will maintain the garden (watering, weeding)? How will summer maintenance and harvesting occur (for school gardens)? How will produce from the garden be used?</p>	



Physical Resources

<p>Keeping your goals in mind, what materials do you need to build, expand or better use your garden? Which items can be obtained from:</p> <ul style="list-style-type: none"> • Donations • Municipal Resources • Borrowing 	<p>___ fencing ___ lumber for raised beds ___ containers ___ soil compost, and amendments ___ mulch ___ tools ___ seeds, seedlings ___ watering supplies ___ harvesting equipment ___ food preparation and serving materials ___ other</p>
<p>For items you will purchase, where will you get the funds? • Donations (from garden clubs, community businesses)? • Small grants? (list any you anticipate applying for) How much money do you need for startup costs?</p>	
<p>Where will tools and other materials be stored? Is this accessible to the people who will be maintaining the garden?</p>	
<p>What materials do you need that can be paid for with FSNE / EFNEP / 4H funds?</p>	<p>___ curricular / educational materials ___ food preparation and serving materials</p>
<p>What materials do you need each year to maintain the garden? Which can be obtained through donations?</p>	<p>___ mulch ___ seeds, seedlings ___ fertilizer or compost</p>

Educational Resources

Are you currently using a gardening curriculum? If yes, list curriculum(s) and source(s).	
Do you feel that the curriculums you have available to you will allow you to adequately meet the educational goals of your program?	
What other content/resources do you need to identify in order to reach your educational goals in the garden?	

Evaluation

Revisit the goals for your gardening program listed in the first section. List specific, measurable indicators that you will use to assess your success in meeting your goal(s).	
How will you collect data on the above indicators?	

Safety in the School Garden

A school garden can be used for growing tasty and nutritious vegetables, fruits, and herbs, and for teaching youth valuable life skills. An edible school garden can serve as an engaging classroom for attaining a wide range of educational goals, such as learning about math, science, and health. Working in a garden also provides fun, recreation, and exercise, and gives children a first-hand look at the wonders of nature.

School gardens are generally safe, healthy, and enjoyable environments, but it is important to keep safety in mind when children are in the garden or consuming the fruits of their labor. Whether a school gardening program includes a large in-ground garden or simple containers for growing herbs, certain precautions must be followed to avoid potential hazards in the garden – such as insect bites, poison ivy, sunburn, or metal garden tools – and to keep food that is grown safe and wholesome.

Thousands of people in the U.S. become ill each year from eating commercially grown fresh vegetables and fruits that are contaminated with pathogenic (disease-causing) microorganisms. In fact, more foodborne illness outbreaks are linked to fresh produce than to meat or poultry. Bacteria such as Salmonella and E. coli O157:H7 cause foodborne illnesses. Contamination occurs when food crops come in direct contact with these or other pathogenic microorganisms from animal droppings, human waste, polluted water, contaminated equipment or utensils, or other sources. Fortunately, the risk of developing a foodborne illness can be minimized. This fact sheet presents common-sense guidelines for the safe handling of foods grown in school gardens, keeping foods free from pathogens, and maintaining a safe environment for children and teachers working in the garden.

Select the garden site carefully

- Locate the garden away from wells, septic systems, in-ground tanks, and dumpsters.
- Avoid areas where water collects. Vegetables and herbs will not grow well in poorly drained soils that have standing water after rainfall.
- Choose a level site. Sloped ground can lead to soil erosion and nutrient run-off.
- To avoid damaging underground pipelines or wires, contact “Miss Utility” (1-800-257-7777 or <http://www.missutility.net/>) before digging in the soil.
- Contact the local school system facilities planning department before starting a garden for any other site considerations.

Soil and compost safety

- Soils can contain lead, which is toxic to the nervous system. It is important to minimize the exposure to lead, especially among children who are most affected by it.
 - Test the soil for lead regardless of your location. All soils will have a natural, background level between 5 ppm and 40 ppm. Do not locate school gardens in an area where the total estimated lead level is above 500 ppm.
 - Lead can be absorbed into plant tissue, but the greatest exposure occurs when contaminated soil dust is inhaled, when contaminated soil is ingested by young children, and when soil particles containing lead adhere to garden produce that is later consumed.
 - Information about lead is found in fact sheets HG#18 and HG#110 listed under “Resources” on page xvii (Note: An example of a soil lead test is the one offered by the University of Massachusetts – contact information is on the last page of HG #110- see “Resources” below).

- Compost improves soil quality and should be added every year with these recommendations:
 - It is a good idea to wear gloves when handling compost. Whether or not students wear gloves, they should always wash their hands after handling compost. Use a fingernail brush to remove particles trapped under the nails.
 - Do not add any farm manure or pet waste to compost bins or garden soil. Animal manures contain human pathogens that can contaminate vegetable crops. Commercial manure products (composted or dried at high temperatures) are safe to use in school gardens.
 - Items that can be safely composted include vegetable peelings, leaves, grass, and shredded paper.

Know your water source

- Be familiar with the quality and safety of the water source you use in your garden. If you get your water from a municipal or public water system, it is probably safe and drinkable. Check with your school system or water company if you are not sure about potability.
- If your school uses well water, have the water tested at least once a year to make sure it meets the Environmental Protection Agency standards.

Working in the garden

- Students should not eat anything from the garden unless they are sure it is an actual food. Students should check with an adult if they are not sure.
- Students should learn which plants have both edible and poisonous parts. For example, only the tomato and not the tomato leaves should be eaten.
- Have all parents sign permission slips that list potential hazards and that allow students to work in the garden. Record all allergies, including food and insect, and provide a first aid kit and drinking water.
- Students should wear proper shoes to protect their feet from cuts and stings. Bare feet, sandals, or flip flops should not be allowed.
- Students should be encouraged to wear hats while gardening, and to apply sunscreen to exposed skin if they expect to be in the garden for more than 15 minutes.
- Students should be encouraged to walk on pathways when available.
- Students should wash their hands thoroughly after returning from the garden, using a clean nail brush.
- Be aware that exposure to the sap, leaves, and stems of certain plants (such as squash or tomatoes) can cause mild skin irritation or contact dermatitis in sensitive individuals.

Insects and pest management

- No synthetic herbicides, fungicides, or insecticides (with the exception of mosquito repellent) should be used in the garden, or within 25 feet of the garden.
- There are hundreds of species of insects living naturally on school grounds. The vast majority are benign or beneficial ones that pollinate crops or attack other insect pests. The small minority that feed on vegetable crops can usually be controlled successfully using organic pest management techniques.
- Weeds should be controlled with mulches, hand-pulling, and weeding implements – not with herbicides.

Wildlife

- Deer, rabbits, and groundhogs can devastate vegetable gardens. Birds, squirrels, mice, and raccoons can also become troublesome pests. If possible, secure permission, funding, and assistance to erect a fence with a gate. If deer are a problem, the fence needs to be 8 ft. tall. If deer are not a problem, a 4 ft. high fence will suffice. Many types of woven wire and vinyl netting fencing materials are available. A fence will reduce injury to crops, and the risk of harvesting contaminated crops (animal droppings are a potential source of pathogens that cause foodborne illnesses). If rabbits are a problem, wire netting should be sunk into the ground 1 foot.
- Harvest produce regularly and pick up and remove rotting vegetables.
- Don't feed birds near your garden. Wild bird feed can attract rodents. Don't leave standing water in or near the garden. Mosquito larvae thrive in small amounts of stagnant water.
- Restrict nesting and hiding places for rats and mice by mowing the grass or other vegetation at the edges of your garden.
- Cover the ends of stakes and posts with plastic or metal cones to keep birds from resting and defecating in or near the garden.

Tools and materials

- Closely monitor students using sharp tools, such as spades, trowels, clippers, and scissors. Identify which tools are for adult use only.
- Instruct students using tools to stay an arm's length plus the tool length away from the next person.
- No tools should be held above waist level.
- Students should not run or play around while holding tools.
- All long-handle tools should be leaned against a wall or fence when not in use. Never lay a metal rake on the ground.
- Some gardening materials – such as lime, fertilizers, and soilless growing media – may be dusty when poured or applied to the garden. Handling and using these materials should be reserved for older students and adults who are equipped with a dust mask. Wetting the material before use will reduce dust.
- Monitor the garden for tripping hazards, especially tools and hoses.

Harvesting garden produce

- Use clean containers that are made from materials designed specifically to safely hold food. Examples include paper grocery bags, 5-gallon food-grade buckets (that held pickles or other food products), colanders or plastic kitchen bowls. Plastic garbage bags, trash cans, and any containers that originally held chemicals such as household cleaners or pesticides are not food-grade.
- Wash hands before and after picking produce. Use clean gloves (that have not been used to stir compost or pull weeds) or clean hands when picking produce.
- Brush, shake or rub off any excess garden soil or debris before putting the produce into the harvest container or bringing produce into the kitchen.

Storing garden produce

- It is not recommended to wash fruits and vegetables before refrigerating, but to wash them immediately before eating or preparing for cooking. Refrigerating fruits and vegetables with moisture from washing can encourage microbial growth.
- If you choose to wash them before storing, use cool, running tap water and be sure to dry the food thoroughly with a clean paper towel or air dry. Produce with thick skins, like potatoes, can be scrubbed with a vegetable brush to remove excess dirt and bacteria. Wash berries immediately before eating or cooking. Berries that are washed and then stored in the refrigerator will soon become moldy.
- If you choose to store food without washing, shake, rub or brush off any garden soil with a paper towel or soft brush while still outside. Store unwashed produce in plastic bags or containers.
- Keep fruit and vegetable bins in the refrigerator clean.
- If you store fruits and vegetables in the refrigerator, use a thermometer to check that your refrigerator is at the proper temperature (33 degrees to 40 degrees F.).
- Fruits and vegetables stored at room temperature (onions, potatoes) should be kept in a cool, dry, dark, pest-free, well-ventilated area separate from household chemicals.
- Bruised or damaged parts of fruits and vegetables should be cut away before eating or preparing. Throw moldy produce away.

Preparing and serving fresh garden produce

- Delicious garden produce is often eaten raw so it's important to prepare raw fruits and vegetables with food safety in mind.
- Always wash hands before handling any food.
- Rinse fresh fruits and vegetables under cool, running, clean tap water even if you don't eat the skin or rind.
- Never use soap, detergent, or bleach solution to wash fruits and vegetables. These products are not meant for washing produce and may not be safe to ingest. They can also adversely affect the flavor.
- Avoid cross-contamination when preparing fruits and vegetables. Clean work surfaces, utensils, and hands before and after handling fruits and vegetables. Diluted household bleach (1 teaspoon in 4 cups of room temperature water) is safe and effective for sanitizing work surfaces. Let utensils and surfaces air dry.
- If you have leftover produce that has been cut, sliced, or cooked, store it in a clean, air-tight container in the refrigerator at 33 degrees to 40 degrees F. To be safe, do not use fresh, cut-up fruits and vegetables if they have been held longer than 2 hours at room temperature or longer than one hour at temperatures above 90 degrees F., unless you intend to cook them.

Resources:

- University of Maryland Extension Home and Garden Information Center (for gardening and pest questions and problems)
- Visit the website <http://extension.umd.edu/hgic> and click on “Ask Maryland Gardening Experts” to send an email question and photos 24/7
- Click on the “Publications” link for information fact sheets on various pests, starting gardens and specific crops
- Click on the “Soil Testing” link for a video on how to take a soil sample, as well as helpful publications, such as HG #110 “Selecting and Using a Soil Testing Laboratory” and HG #18 “Lead in Garden Soil”.
- You will also find many helpful videos and resources on the “Grow It Eat It” page of the University of Maryland Extension website <https://extension.umd.edu/growit>

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Adapted from:

1. “Garden to Table: Five Steps to Food-Safe Fruit and Vegetable Home Gardening”, by Catherine Violette, Extension Professor and Specialist, University of New Hampshire, Cooperative Extension, Food and Nutrition (part of a grant-funded project led by the University of Rhode Island Cooperative Extension).
http://extension.unh.edu/news/2007/07/garden_to_table_five_steps_to.html
2. “Food Safety in Your Home Vegetable Garden”, by Pamela Geisel and Donna Seaver. Publication # 8366. University of California Agriculture and Natural Resources: <https://cns.ucdavis.edu/sites/g/files/dgvnsk416/files/inline-files/4.foodsafetytipsforschoolgardensusda.pdf>
3. “Checklist for Starting a School Garden”, by Dorothy Mullen, Rutgers Extension Master Gardener -
<http://www.suppersforsobriety.org/Documents/Garden/SchoolGardenChecklist.pdf>

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